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Aviation Week

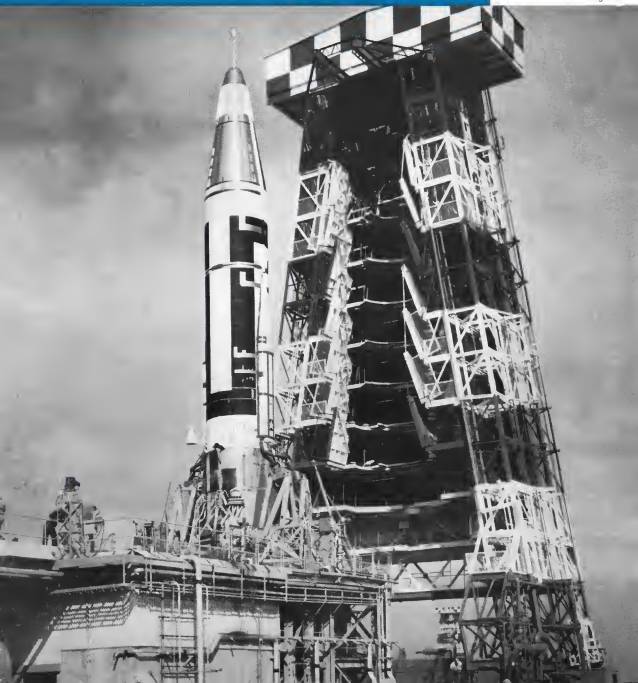
Including Space Technology

A MCGRAW-HILL PUBLICATION

Space May Revive
Biplane, Triplane

●
USAF, Army Argue
Anti-Missile Role

Atlas ICBM on Firing Pod



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Missile Trainer
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Projection



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1951

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AVIATION CALENDAR

(Continued from page 5)

- Symposium on Civilian Manpower Training Equipment (limited to 500), with Bureau (Director), Naval Ordnance Laboratory, White Oak, Silver Spring, Md. For details write Mr. J. C. Vach, Head of New Research & System Division, U. S. Naval Training Device Center, Fort Washington, N. Y.
- Mar. 28—London meeting, Change Year of Construction and Industry Exhibition Committee, Hotel Sheraton, Chicago, Ill. Speaker Gen. Thomas S. Power, Case studies in Chief of the Strategic Air Command.
- Mar. 24-25—Annual Meeting, Aero Medical Assn., Harbor Hotel, Washington, D. C.
- Mar. 24-25—Symposium of Public Engineers National Convention, Waldorf Astoria Hotel and New York Coliseum, New York City.
- Mar. 21-Apr. 4—Technical Management Assn., Management Methods for Public and Private Services, Sheraton Astor Hotel, New York City.
- Apr. 4-10—1951 International Symposium Mechanics, Gasparides Engineering, Rockefeller Bldg., 29 W. 39 St., New York City.
- Apr. 8-11—National Aeronautics Meeting, Society of Automotive Engineers, Inc., Hotel Commodore, New York, N. Y.
- Apr. 10-11—Innovative Training Society General Meeting, Sheraton Hotel, Washington, D. C.
- Apr. 10-12—Society of Engineers of Radio Engineers, Conductors and Electronic Staff, St. Anthony Hotel and Municipal Auditorium, San Antonio, Tex.
- Apr. 10—Institute Testing Requirements of Conductors of a North Electric Section, VI. Telschovsky Electrical Mfg. Co., Engineers Club, Philadelphia.
- Apr. 10-20—1951 Annual National Forum, American Helicopter Society, Sheraton Hotel, Hotel Washington, D. C.
- Apr. 17-18—Institute of Environmental Engineers, Second Annual Technical Meeting, New Yorker Hotel, New York City.
- Apr. 22-24—1951 Electronic Components Conference, Ambassador Hotel, Los Angeles, Calif.
- Apr. 23-26—Second Annual Aerospace Conference sponsored by the Peter Office, of Scientific Research and Institute of Aeronautical Sciences, Kaiser Henry Hotel, Denver, Colo.
- Apr. 27—Fourth National Flight Test Symposium, Springfield, Ill., Sheraton Hotel, New York City.
- Apr. 12-14—National Conference on Aeronautical Electronics, sponsored by Bureau of Radar Engineers, Sheraton Hotel, New York City.
- Apr. 24-26—1951 Meeting Series for Electrical Engineers, Hotel Margot, Chicago, Ill.
- Apr. 13-15—1951 National Council on Aeronautics, sponsored by Bureau of Aeronautical Weight Research, Inc., Belmont Park Hotel, New York, N. Y.
- June 24-1951 National Telecommunications Assn., Lord Belmont Hotel, Belmont Ave. 945—Fourth International Aeronautics Exposition and Congress, Columbia, N. Y., N. Y.

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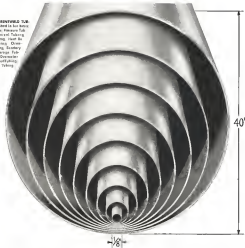


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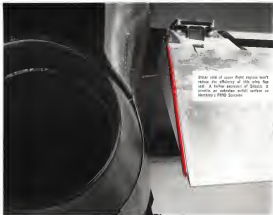
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USAF Studies High-Thrust Space Engine 27

Service developing rocket engine that can be clustered to produce 1,500,000 lb. thrust.

GAA Wins Battle for Airspace Control 38

New CEA office is created to coordinate airspace at intersection of latter civil-military battle.

Radical Configurations May Find Space Role 48

Scientists concentrate on drug propulsion work involving high velocities, hypersonic exhaust.

USAF, Army Battle for Missile Defense 65

Army wants Nike-Zeus responsibility, USAF claims missile does not compare with Nike-Zeus.

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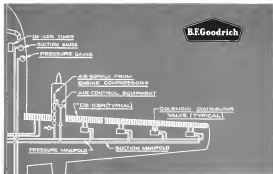
A MESSAGE FROM THE PUBLISHERS

Our 1958 Program

COVER: Last preparation for firing the Corona Atlas SCRV1 test program at the launching point at White Sands. Note the launching stand at Cape Canaveral. The missile is being held upright in a Ballistic Range Launcher weighing and thrust measuring stand. Prior to firing, the propellant keeps an accurate record of the exact weight of the missile and the amount of propellant pumped into the tanks. During the launching, it holds the Atlas and accounts the total thrust and the engine's peak maximum power. Then it returns the missile. It's also the launching arm to observe the complete thrust build-up and stop the engine if there is malfunction.

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72,000 copies of this issue printed
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B. F. Goodrich De-Icers save weight, power on F-27

ONE OF THE FACTORS that contribute to the dependable operation of the Fairchild F-27 is built-in, all weather ice protection designed and developed by B. F. Goodrich.

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A Message From the Publisher

Our 1958 Program

This year the aviation industry will face the most challenging problems of its modern history. These problems include a technical revolution of tremendous magnitude as man begins to attempt his exploration of outer space plus complex political and economic issues. Aviation Week's editorial policy has always moved readily along the frontiers of the industry's technological expansion.

Therefore, we are establishing with the greatest care (see pages 27 and 48) a new major department of space technology headed by Evett Clark, who is widely recognized as an authoritative reporter on this subject. Aviation Week's space technology department will cover the entire spectrum of this burgeoning new area such as basic research, development of space vehicles including rockets, launch factors, communications problems, new propulsion methods and all of the other new techniques that will eventually ensue. In directing this department of space technology Mr. Clark will be supported by the full editorial resources of AVIATION WEEK including 30 graduate engineering and aviation specialist editors. The importance of space technology to the future of this nation and as aviation industry's successful national space policy by the White House, the Postage, the National Advisory Committee for Aeronautics, the Congress and the American people. It is becoming increasingly well recognized that the aviation industry with its related technologies which have already contributed in many to the development of national strength and security is the logical platform from which to launch the conquest of space.

As Lt. Gen. Donald I. Pitt, USAF Deputy Chief of Staff for development, strongly pointed out:

"There is no loss for the argument that there is an essential difference between astronomy and astronautics." The latter is only a part of the larger whole. Astronautical science embraces the flight of air vehicles that leaves the surface of the earth and goes anywhere by whatever means."

Gen. Thomas D. White, USAF Chief of Staff, further observed:

"The rockets that are getting the headlines today are but one step in the evolution from manned aircraft to piloted spacecraft."

Gen. Cyril Cook, president of the Aircraft Industries Assn., has also noted the evolutionary nature of the man. He said: "Just as we enter the so-called 'middle age' it suddenly appears that it was only a young man, that the next step is to add a man to a machine. Then we give that manned vehicle another man to fly it

the target and we are back where we started—back to the manned vehicle. All we have done is to provide man with a historically unexcused reach both in space and time."

During 1957 AVIATION WEEK's extensive coverage of space technology, along with all of the other facets of the total aviation picture, made it the most widely quoted technical authority on these subjects in the daily press, both in this country and abroad, in general circulation and management magazines such as *The Saturday Evening Post*, *Business Week*, *Time*, *New Yorker* and in congressional debates on the defense issue.

The editorial materials attracted an ever-increasing list of top-level industry, military, scientific and legislative subscribers. The first paid Audit Bureau of Circulation figure for December, 1957, was 67,000, with a current figure of 78,000 and a renewal rate of 73%. AVIATION WEEK's subscription price is \$7 per year.

This acceptance by the aviation industry resulted in the largest advertising volume ever placed in an aviation magazine.

During 1957 a total of 5,658 pages were run in AVIATION WEEK, representing an increase of 173 pages over the previous record total of 1955.

The aviation industry rallied to order, during the coincide year of last summer and early fall but already shows signs of subsiding during 1958. The industry began 1958 with a backlog of \$17.5 billion in contracts for military aircraft, missiles, aviation equipment and civil transport. The Fiscal 1958 Defense Department budget submitted to Congress by President Eisenhower last month called for total procurement expenditures in aircraft, missiles and air base equipment of \$10 billion during the fiscal year beginning July 1. New contracting authority requested in the budget total \$30.4 billion less in these same categories. These totals already have been boosted by a \$1.2 billion supplemental request for Fiscal 1958 submitted to Congress in January with an indication from Defense Secretary Neil H. McElroy that further supplementals may be forthcoming to push high priority defense programs. In addition to these procurement funds, \$2.2 billion was requested in research and development funds, the bulk of it in aviation and its related technologies.

During the year ahead, the aviation industry will need both a vigorous voice and a strong public conscience. AVIATION WEEK will continue to do both these jobs without fear or favor and with accuracy as its guiding principle.

—Robert W. Meffin, Jr.



Lycorning puts top-flight power in the Vertol 105

Recently a Vertol copter's piston power plant underwent a dramatic conversion: its reciprocating engine was replaced with two compact T-53 gas turbine engines.

The result—the Vertol 105, which operates at greater speeds, with greater loading capacity, and with a much lower base cost than the reciprocating engine version.

The conversion is proof to all engine manufacturers that they can install turbine power without having to design entirely new ships.

The powerful, economical T-53 is a product of Aero's Lycoming Division and was developed under the sponsorship of the U.S. Army and the U.S. Air Force. Lycoming engines power some different types of land and rotary wing aircraft than any other engine in the world.

Avco today—a diversified organization whose products include aircraft power plants and structures, missile research and development, electronics for defense and industry, and specialized home and farm equipment.

Regularly enhanced on unusual opportunities for advancement can grow with Avco.

Avco makes things better for America

Avco

Avco Manufacturing Corporation
420 Lexington Avenue, New York, N. Y.

WHO'S WHERE

In the Front Office

Edward J. Healey, president of Allegheny Ludlum Steel Corp., a domestic working issue, is in the U.S. Pittsburgh, Pa.

Fred W. Kinross, a director and assistant to the president, The New York Air Brake Co., New York, N. Y.

Edward A. Lark, president General Petroleum Equipment Corp., New York, N. Y.

David A. Mason, president Lark Associates, Inc., Washington, N. Y.

M. A. Chambers, president National Machine Products Co., Union, N.J.

E. U. DeFuria, executive vice president, Sperry Gyroscope Co., division of Sperry Rand Corp., New York, N. Y.

Honors and Elections

Dr. Louis N. Belfrage, head of research for Lockheed Martin, Software Division, has been appointed to the Air Force's Scientific Advisory Board.

James S. Arnold, Stanford Research Institute, physicist, has been elected vice president of the Northern California Section of the American Society for 1971.

Dr. Karl Amdur has been awarded the Navy Distinguished Public Service Award, the highest honor which the Navy can grant to a civilian, for his outstanding contribution to the Navy Department in the field of scientific research and development.

Dr. Amdur served in 1971 as vice president in charge of engineering for Goddard Space Flight Corp.

Carl Brent Robinson (USAF), ret., has been elected a member of the board of governors of the Flight Safety Foundation, Inc., New York, N. Y.

Princeton University has officially named the investigators leading the seminal research at the James Francis Research Center, Stone Hall on campus of the late Colonel Clarence S. Adams.

James H. Hines, chief scientist and managing director of Martin Marietta, Aircraft Division, has been awarded the Lacey Taylor Barberie Air Safety Award by the Flight Safety Foundation, Inc., Mr. Hines' first honor to receive the award, was bestowed "for his outstanding contribution to the safety of civil high performance aircraft through the design and development of optimum seats."

Changes

Robert A. Baker, manager of engineering, Wire and Cable Division, The Electric Wire and Cable Co., Toledo, Ohio.

Earl K. Patten, general manager and chief engineer, Sales Manager, Martin Marietta, Aircraft Division, The Christchurch Machine Co., Reno, Nev.

Wig Gora, general manager (USAF) assistant executive manager, Lytle Engineering & Mfg. Co., Chicago, Ill. Gora's headquarters will be at the Alouette III, St. Louis.

INDUSTRY OBSERVER

An Research and Development Commands Ballistic Missile Division has put development of solid propellant engines for sub-orbital ballistic missiles on a shaky basis.

An Force is considering Boeing proposal for a Mach 2 liquid-propellant engine development target design that also would be fitted with air-breathing ramjet powerplant equipment. Known as Project Power, design would have relatively low cost. It would be launched from a mother plane and be non-recoverable.

Rear or nuclear powered rocket engine to be fired into the rear was designed and developed by AEC University of California Los Alamos and Lawrence Livermore Laboratories. Test will be carried out at AEC's Livermore, Nev., facility.

Sperry will do research and development of AN-FPS-35 3,000-hp, variable direction and tracking radar. Response is to develop an integrated system combining in one piece of equipment and one antenna a search detection and missile tracking capability. Radar set will use coherent detection and active beamforming, very high power transmitter and on-board facilities as active. Sperry, which has \$22 million letter contract, probably will do extensive subcontracting.

An Force has a high priority project to replace a cockpit design at very high altitude as part of Operation Headset, of Atomic Energy Commission's Easwell test ground. Area plans similar flight during the operation, using its Redstone missile (AW Jan 20, p. 26).

Consolidated B-52 operations bomber has a new pod configuration in which fuel sections can be dropped while aircraft retains nuclear or thermonuclear position of the weapon. Drop would be made in event the bomber is intercepted or unable to target. Flight test of the new configuration test already has been conducted.

Sperry's present submarine fleet has an estimated four vessels equipped with 500-mile-range cruiser launchers comparable to Chinese Yuan's submarine fleet. It plans recently showed its submarine production and apparently is retreating and turning its technology to large submarine of long-range nuclear role.

Testative schedule for North American Aviation's F-105 language interpreter computer production of two aircraft in 1968, one in 1969 and seven or more in 1971.

Italy hopes Selenia will be chosen as the base for NATO's intermediate ballistic missile test range over France's Colomb Beaufort range in the Sahara is not of the question because of the unstable North Africa political situation.

Test instruments in testing its photographic mapping radar system with RB-66 based from Air Force Flight Test of the new sub-orbiting radar system are made from Elliot's Long Field. Results thus far apparently have been good.

Production Texas Toolfish air base transfer has made 57th Fleet unit (designated by the airframe manufacturer) testing improvements on early configuration furnished earlier. New motor has cut weight a weight to 145-155. Entry needs motor components to a government operated facility for loading.

Kaman Aircraft has received an order for 850 of its H-47 four-bladed single main rotor and tail rotor helicopter from Strategic Air Command. Two helicopters will be stationed at each SAC base.

About 11,000 Selenia order entered graded nations transfer to USAF and Navy are scheduled in order than in. Approximately 18,000 Nike Ajax ground-to-air missiles have been built to date.



MISSILE GUIDANCE SYSTEMS

Projects of H. T. Budenbom,

Senior Scientist, Stavid Engineering, Inc.

Included in the Stavidbom 20 patents and numerous technical papers are his original contributions in missile development and authorship of many new concepts in the application of electronics to modern warfare. His experience and inventive talents are being applied to Stavid's projects in weapon systems development and missile electronics. Mr. Budenbom is one of a group of outstanding scientists and engineers at Stavid who are working on advanced concepts . . . years ahead of normal systems development.

In Stavid's dynamic engineering atmosphere, scientific development and manufacturing teams are producing a wide range of electronic systems for all branches of the military. A typical project calls for development of the high power Radar for AN/SFQ 31.

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OTHER STAVID PROJECTS INCLUDE:

- Air Missile Systems
- Airborne Search, Identification, Target Classification Radar
- Missile Tracking Receiver
- LANDO Weapon System
- Parabolic Antenna
- Fire Control System
- Automatic Missile Guidance System



Washington Roundup

Killian 'Unexpediter?'

Just Congressional Atomic Energy Committee has scheduled Feb. 26 for a showdown with the Administration over the fate of the nuclear-powered aircraft program. The aircraft research program is now being studied by Dr. James Killian, presidential science adviser.

The committee wants Air Force to give the 'go ahead' on a 'crash' program aimed at having an aircraft flying within two years. Rep. Milton Papp (D-IL) chairman of the research and development subcommittee, emphasizes the technological as well as the safety requirements to the U.S. of being first with the atomic plane. He vigorously opposed a crash by Navy to attempt to work out a deal on the proposed USAF program which is objectionable. Navy program might be considered (AW Jan. 17, p. 21). This project is given a nuclear airplane has already literally been studied to death over the years of its existence. "Pope doubted 'What the program needs is action, not another study group."

The Atomic Energy Subcommittee however gave Deputy Defense Secretary Donald A. Quarles until late Monday to make a final decision on the program. "Pope reports that Quarles reported he could not produce a decision since the program had been turned over to Dr. Killian for study. Dr. Killian's language on the subject is equivocal," Pope reported. "He has turned out to be an unexpediter."

Meteorology Research

Commerce Department plans to expand its meteorological research program. Commerce Secretary Stanley Wicks is asking Congress for legislation authorizing the department to enter into contracts with private research institutions. At present, the department can only enter into such contracts if the research is directly related to the safety and efficiency of an investigation.

"If the department were to attempt to purchase all meteorological research at its own facilities with its own personnel, substantial temporary increases in both facilities and personnel would be required," Wicks writes. Sen. Warren Magnuson (D-Wash.) chairman of the Senate Commerce Committee. "Research conducted outside available the desired facilities and experienced personnel at far less cost to the government."

CAB Ethics . . .

Investigation of the House Subcommittee on Legislative Oversight into federal regulatory agencies is going rapidly in legislative defining relationships between industry and Civil Aeronautics Board and other agencies agencies. A massive subpoenaed list sent to the Senate by Sen. William Proxmire (D-Wis.) and to the House by Rep. Morgan Kousser (D-Ma.) would bring gifts or gratuities to members of regulatory agencies. Senate aviation group's subpoenaed to its sponsor the Proxmire bill-Senate "Thunder" (D-S.C.), William Lange (R-N.D.) Harbor (D-Mass.) Lister Hill (D-Ala.), Chester Anderson (D-N.M.), John Sparkman (D-Ma.) and Wm. Wayne Morse (D-Ore.).

Legislation introduced by Sen. Hiram Johnson (D-Wash.) setting criminal penalties for officials of regulatory agencies who would substantiated looks of

information and members of industry who are present on regulatory officials is already pending.

. . . Schwartz and National

However, the slow pace of progress being made by the House Subcommittee on Legislative Oversight is an indication that an investigation of the Civil Aeronautics Board may be a long way off, if it comes about at all. Witnesses testifying in the Federal Communications Commission report of Johnson charged 10 in House to National Airlines are being questioned in great length by subcommittee members and new, new cases of persons allegedly involved in this case have been suggested in further witnesses.

Some observers at the hearings believe that the line of questioning has now been expanded to shed an "acid light" upon accusations made by ousted owner Bernard Schwartz. Schwartz told the subcommittee that he had gathered leads on possible outside intervention in CAB cases which should be investigated by thorough questioning of the persons involved. Among the names mentioned were President's Assistant Steven Adams.

Snow Lift

Fed Office Department has turned to the commercial airlines to help in the battle against the backlog of first class three seat seats that accumulated in years of firing from a shortage of airline transportation is a result of last week's storm that blanketed the eastern portion of the U.S. with deep snow. Large volumes of mail were diverted from airlines to the air routes in Boston and other New England centers for mail routes to Pittsburgh, Chicago, Washington and points in Florida. Most trapped in New York by lack of winter transportation were flown to Washington, Pittsburgh and points west.

Coast Guard Aviation

Cost Guard has a three-year \$85.4 million program to build its air fleet from a total 118 to 144 aircraft. It involves a 23 aircraft program for three years to replace six oceanic aircraft and an annual 521.6 million program for the next four years. CG plans to buy Martin P4M Marlin amphibious Lockheed C-140 Hercules land plane, Grumman UF Albatross amphibious Seisler RB-1, oceanic helicopter and Bell 4801, light helicopter.

False Security Spread

Like security apparatus, it is a problem in Europe. General Defense Matters has charged a strong attack across around the country's latest military aircraft being pulled out of the Lowland plant of Westinghouse and further action steps caught in cloud officials. Meanwhile, the long hours of public assault behind the scenes are being photographed frequently from Russian fighters missing days, down the area adjacent to the company's world. The secret airplane Republic F-490s and RB-347s built in the U.S. under a 1955 contract and long since described in accurate detail by the technical aviation press of European countries as well as by Aviators Week.

—Washington staff



Atlas Thrust Is Measured on Pad

Boosting engines on the Cosmos Atlas RCBM are run at full power approximately before the missile is released during firing of Patrick AFB, Fla. (left photo above). Unit which is restraining the missile and maintaining the thrust is built by Bellows-Luna-Houston Corp. It smooths the complete thrust buildup and if the engines are not operating properly the launching can be stopped (SAM Aug. 3, 1957, p. 58). Atlas is released in control pattern and then thrust is plotted separately. This was not a maximum thrust weight test as the sea-launch engine was not installed. Go procedure is source of engine phase (below, right).



Space Technology

USAF Studies High-Thrust Space Engine

By Evert Clark

Washington—USAF has initiated development of a single-chamber rocket engine that would produce 1,800,000 lb of thrust and which whose costs could be made to fit together to weigh less than 3,500,000 lb in use with latest space vehicles.

Richard E. Herring, USAF Assistant Secretary for Research and Development, told the House Armed Services Committee last week that studies leading to an engine that could be developed to produce 1,800,000 lb were initiated in 1954.

"This engine was put under active development about two years ago," Herring said. "Although we have still not identified a specific application for it, we are certain that it will be useful for many astronautics applications."

Development of the single-chamber 1,800,000-lb thrust engine was initiated "somewhat more recently," Herring said.

"Here again, we have no specific application, but it is certain that this is the next logical step as a program to assess our future technical capability to react."

Herring said these examples illustrate the fundamental research and development principle that "we must support a broad technical program that establishes a sound foundation of scientific knowledge upon which we can build superior components and techniques for the weapon systems of the future."

High Risk Approach

"We must be established in our field of imagination in formulating exactly the application for each element of the program." At the same time, USAF must success a high degree of scientific, engineering measurement and utilizing the most productive lines of development, Herring said.

"In this respect, it is important to be critical of the conservative approach as well as the high risk approach, that might waste our dollars in an effort that cannot prove fruitful," Herring said.

"In general, the effort to make a big achievement always involves a relatively high risk."

"We cannot be too fearful of failure, for a research and development program that attempts only the sure thing is sterile and productive of only a small or short-term gain."

"The attack that are needed in the current technological competition certainly warrant—indeed they demand—that we reach for the largest possible advantage from technological advance

accepting occasional failure as necessary and recognizing that the laws of discovery are not in the area to which we'd."

This is perhaps the strongest statement regarding the importance of taking a bold approach and making technical risks that are, As Herring leads his study into the launching of Sputnik I.

Concept of doing research in developing hardware for which no specific requirements exist has several basic principles that will be the success, the Defense Department as on Caged 1951—firstly because specific requirements always compete with such projects for limited appropriations dollars.

While USAF has been conducting research toward space flight for years, such programs have led to flight land for survival even within the Air Force and most have not been successful.

Carrollton 'Cheer'

Sputnik landings in fact come in the midst of severe curbing of the very kind of research and development program Herring discussed. He took note of the effect of this as he testifies before the committee.

Herring pointed out that USAF has more than 5,000 active R&D contracts with some 170 industrial and non-profit contractors and more than 3,700 industrial organizations.

In an effort of this scope and magnitude, the class that is created by market changes in the kind of support can scarcely be imagined," Herring said.

"It is through the program that we have made in the last 10 years has been truly remarkable, I am sure, that its expense has been greatly increased by the increasing number of contractors in the area that are available for an enterprise of this type."

Soviets Warn of Circumlunar Difficulty

Moscow—Russia public relations men the success of Sputnik I and II is being worried not because every optimistic over the possibility of its early Soviet launch of a man-to-moon vehicle.

Professor V. Shcherbin, writing in the government newspaper *Pravda* says that the task of orbiting an artificial satellite around the Moon is very far from the practical capabilities now available to us."

Shcherbin said the same problem is the need to boost a satellite speed from the present 30 kilometers per second to 17 kilometers per second within three days—114,000 kilometers in one pass with the 1,700 kilometer apogee of Sputnik II. He added:

"Knowing that two-kilometer per second speed increase is a far from simple job," Shcherbin also said that manned flight to the Moon will not be accomplished within the next future.

More Missile Submarines Asked To Combat Soviet ICBM Threat

By Fred Eastman

Washington—Rep. Clement Cannon (D-Mo.) secured his plan last week for construction of more missile-powered missile submarines to replace the submarine bombers of Strategic Air Command when they become obsolete.

Rep. Cannon chairman of the powerful House Appropriations Committee, said in a floor speech that the U.S. has its greatest threat after Soviet intercontinental ballistic missiles because positioned not before those of the U.S. are protected. It is only a matter of time, he said, before the Soviet Union will have mastered SAC, and the U.S. will be without nuclear means except for missile submarines. He added that a concerted attack might give the Kremlin control of the world in a week.

Fred of Santa's Polaris missile submarines is scheduled to make a committee report on October 1968. Soviet ICBMs in December, 1959.

Referring to a report by Adm. Adolph Borge, chief of naval operations, Cannon said a possible method of attack by the Russians might be the use of missile-launching ships designed as merchant ships that could sail any where in 150 or of the coast. He added that 75 out of 50 of the largest cities and 85% of the industrialized areas of the world are within 500 mi from the coast.

Power Decline

Cannon said the U.S. was the great military power in the world but has lost sea at the end of World War II but that this power has declined to the last few years. The rate of Russian expansion has been unprecedented, he said, and our air was superior and our naval but in the production of capital goods and materials.

"The expansion of the Red area has been amazing," Cannon said. "Russia now has 174 divisions and five army-corps, increased capability of mobilizing a total of approximately 300 divisions in 10 days. The United States will maintain

in the next four to 14 divisions with these Marine divisions."

The Appropriations Committee chair said added that Russia has not produced the U.S. in six submarine tonnage by us in one, in destroyer tonnage by us in one and in cruiser tonnage by 14 to one.

He pointed out that, although the Soviets have not built a single cruise, it has the greatest submarine fleet that would be over sea and is building another faster than any other nation.

Cannon on U. S. Log

We are behind the Russians in the following areas," Cannon said.

- Race for outer space.
- Production of intercontinental ballistic missiles.
- Submarines.
- To Army and Army missile and tanks.
- Air force survey and exploration—no development. They are using 70 long-range jets, and we are employing eight.
- Radar. "They have about 10 times as much as we have, and it is more effective against high flying bombers."
- Production of atomic and nuclear weapons.
- Development of rocket fuels.

Cannon added, "We are ahead of the Russians in supercomputers, lunar hotels and scaling lasers."

He said the U.S. has met the other more than for with SAC. It 32-to-long range, long-range and nuclear sea-based.

Cannon said there are about 350 North American Foreign Depositories and 250 national embassies dispersed in Western Europe where SAC can find any military objective in Russia in composite, by means.

"The Russians are now building a new air defense system, using improved radar and sub-orbit missile with nuclear warheads with which they intend to block the SAC bombers at the border," he said.

"It is feared," he added, "that very shortly the Soviet defense will be made as effective as the Air 108 B-52 or B-70's striking. If Moscow would be shot down before reaching the target. In other words, within a year it may take 108 planes to land one bomb. When this will have been effected SAC will be relegated to the limbo of

the past along with the cavalry, its regiments and the blindfold."

The Navy report maintains a possible attack by missile-launching ships designed in excellent search, Cannon said, which would be more difficult to recognize than one by missile-launching submarines.

If such an attack could succeed in weeks and launched them within one hour, 12 ships could be used to replace 15 submarines assigned for a submarine attack, he said. "There would be an ideal normal condition about 75 air detached ships within 500 miles of the coast of one given base, and quoting the Navy report, if our only means of intercepting a raid consisted of a single aircraft to track such vessels, the ship would be unable to launch missiles or move out beyond the assigned coastal base, positive numbers of aircraft would be required for the anti-aircraft effort, even for short periods."

As for the use of missile submarines in an attack on the U.S., Cannon said that no reasonable amount of anti-submarine effort can prevent successful damage. He said that the Atlantic coast it is expected that five out of 11 submarines could be destroyed, while one out of five could be sunk in a West Coast sea.

Cannon and 105 Soviet submarines could damage up to 67% of all-parked SAC aircraft in the U.S.

Cannon charged that the U.S. would not be as "decisive" as the Navy had not pointed an big appropriations bill for the defense of the coast when the assets, time and attention should have been given to the development of American missile submarines and missiles.

USAF Promotions

Washington—For Air Research and Development Command officers have been announced for temporary promotion from regular to major general. They are:

- Brig. Gen. Walter T. Wynn, commander, Wright Air Development Center.
- Brig. Gen. Victor B. Hagen, assistant deputy commander for weapons systems.
- Brig. Gen. Don R. Oberholt, deputy commander for research.
- Brig. Gen. Steven C. Dewler, deputy commander for research and development.

Those promoted by President Eisenhower to permanent major general include Brig. Gen. Chester M. McGee. USAF assistant chief of staff for public relations and Brig. Gen. Ben J. Fish, deputy director of Ballistic missile Air Material Command.

Rocketdyne Gets Atom Engine Contract

Washington—Nuclear rocket engine research and development has been awarded to Rocketdyne Division of North American Aviation Inc. by Air Force.

Contract is being administered by Wright Air Development Center of Air Research and Development Command, and Atomic Energy Commission.

North American has been doing experimental research studies on nuclear engines since 1946.

AEC is expected to ask Congress soon for more funds to accelerate nuclear rocket work (AW Feb 17 p. 29). Its latest nuclear rocket engine is scheduled for test during later this year. Rocketdyne, with main office in Canoga, Calif., has just opened the Rocketdyne Research Center at the Propulsion Field Laboratory at the Santa Susana Research Facility to include a propulsion field laboratory which the company said is "believed to be the equal of any similar laboratory in the West Coast," including those of major air commands and a federal contract. New center together with chemical and metallurgy laboratories in Canoga Park employ some 170 researchers.

North American also has signed an eight-year lease in Canoga, Calif., leased last month in McGee Tex. under equal ownership by NAA and Phillips Petroleum Co. Activities will be research, development and manufacture of high energy solid fuel and solid propellant motor engines.

John F. Yarnes, former director of research for Rocketdyne will lead development and engineering. Richard J. Mendenhall, former contract manager and manufacturing in Phillips, will take charge of McGee Tex. will head manufacturing.

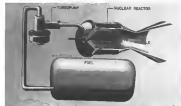
R. L. Swain, former quality control manager for Phillips, will do the same job for Air Force. Corp F. Yarnes' former group leader as solid propellant for Rocketdyne will be Air Force's plant engineer.

L. L. Mendenhall, former assistant plant manager at McGee Tex., will direct personnel and administrative. Contracts and proposals department will be headed by Kenneth F. Johnson, who held the same job with NAA's Yarnes Division.

Richard K. Moore, former public relations chief at Pratts, will direct public relations and Paul J. Frank, former chief construction of Phillips, will be in charge of construction at Canoga Park. He will be controller. Vice president and assistant general manager of Air Force is Thomas E. Myers, for use manager of plant engineering at Rocketdyne.



Nuclear engine under test stands toward Moon at Rocketdyne, after's completion of space flight. First test being scheduled for later this year at Nevada proving grounds.



REACTOR located in combustion chamber in this advanced design would provide energy to convert fuel to ultra-high temperature gas which would expand. Using working liquid salt as medium, before it hydrogen, the nuclear rocket can achieve specific impulse of 800 to 900 sec., according to one Rocketdyne spokesman.

Powerplant, Navigation Progress Help Trim Timetable for Polaris

Washington—Beltroughts that have permitted Navy to set its timetable for operational introduction of the Polaris fleet submarine vessels for three years to the present date of October 1969, have been in areas where most trouble was expected.

Major projects have been made during the past year on both thrust detector systems and reactor control, respectively, but problems in solid propellant.

Navy also is approximately a year ahead of two years ahead of schedule in solving the navigation problems associated with firing intercontinental range ballistic missile from sea.

Heart of the navigation system for Polaris submarines will be the Ship's Inertial Navigation System (SINS) and solid propellant for the Ship's Inertial Measurement System (SIMS). The system will give it an area base the latitude, longitude, local vertical and pressure elements.

Navy, with \$730 million made available through Fiscal 1973 budget appropriations, has ordered that of the Polaris submarines now greater than two to be built by the Electric Boat Division of General Dynamics

Corp., Groton, Conn., the third by the Naval Island Naval Shipyard, Vallejo, Calif. The submarines, which probably will be the world's largest, will carry some 16 of the 47.6 long Polaris vessels.

Weight of each submarine will be 5,400 tons. Polaris weighs about 15,000 lb.

To lessen chance of crew injury and sleep deprivation some parts of the Polaris will not cut or cold after the missile has been launched from the submarine at a probable depth of 100 ft.

Missiles will be stored and fired vertically, leaving the submarine through water to the forward deck.

Naval Secretary Thomas S. Gates Jr. has said that six additional missile launchers can be built under the same time limit, or sooner, if the Defense Department and Congress approve a request for an additional \$1 billion.

In development of the missile itself, the design is based on the specific pulse of the solid propellant powerplant has been set as schedule by the contractor, Avco General Corp.

Good progress also has been made

in experiment planning and equipment design and in engineering the methods for environmental ground tests.

Navy, in the first development of the Polaris, plans a two-rocket power plant this month, then launch again previous solid propellant work by both Avco and Avco. The article also mentioned the first two case cited by the Naval Advisory Committee for November.

Navy is still waiting to refine the reactor, including a lighter one and lighter weight to obtain one stage. It also hopes to replace its reactor base and stabilizers.

NACA Space Group Holds First Meeting

Washington—Space Technology Committee of the National Advisory Committee for Aeronautics has held its first meeting to consider working together with NASA and other agencies on problems of flight beyond the atmosphere. Groups and their members are:

- **Orbiters**—Dr. James A. Van Allen (University of Illinois, State University of Iowa)
- **Vehicles**—Dr. Wesley von Braun (director, Development Operations Division, Army Ballistic Missile Agency)
- **Reentry**—Dr. Milton W. Gussler, director, Aeronautical Laboratory, RAND-Washington Corp.

- **Range, launch and tracking**—James R. Dornay, manager, Aeronautical Division of General Dynamics Corp.
- **Instrumentation, communication and navigation**—Dr. William H. Pelletier (director, Jet Propulsion Laboratory, California Institute of Technology).

- **Space navigation**—Dr. Howard W. Bush (director, Mathematics Research, Bell Telephone Laboratory).
- **Human factors and training**—Dr. W. Randolph Lovelace, Jr., Lovelace Clinic, Foundation for Medical Education and Research.

New members of the committee under Armstrong Wertz reported its membership as Feb. 1 (page 3) are:

- **Col. Norman C. Fook**, assistant to the deputy commander for weapon systems, Air Research and Development Command.
- **Abraham Bloch**, research and test office, assistant chief for research and development, Navy Bureau of Aeronautics.

All 16 members attended the initial meeting, NACA, Chairman James H. Doolittle and NACA Director Dr. Hugh L. Dryden also participated.

The initial teleconference by Peters was held at the time of an Avco Corp. ball which followed accelerated design proposals. They will be processed by water-cooled reactors.

Largest Solid Propellant Engine Static-Fired in Thiokol Fuel Test

By Michael Yaffe

New York—Thiokol Chemical Corp. has static fired the largest solid propellant rocket engine ever made.

The engine contained over 10 tons of propellant, Thiokol President John W. Crosby declared last week, at a viewing of the Chemical Industry Area. Crosby compared the engine with the two largest solid motor propellant motors, the Thiokol and the first stage of the RV-110 and the other for the first stage of the X-17.

The RV-110 engine contained only 4,500 lb. of propellant but generated over the first stage of the X-17 on a test stand. Tests that it was done, a still less than that of the largest liquid propellant test now available, the 165,000 lb thrust Test engine.

But Crosby said his company could build a solid motor as large or larger than the Thor's.

Change in Outlook

As protest, solid probably account for less than 35% of the money being spent on missile propellant but the percentage will increase according to Crosby. This does not mean that there will be a complete switch to solid, since liquid propellant, he said, will continue to be an important factor.

Solid can be easily stored, generated, stored down to three or six years and out, Crosby said that they still can't be repaired or throttled and so cannot be used for guidance and control systems, he added.

Consequently, the primary application for solid remains in boosters. Rocket men will continue to use liquid for sustaining flight. Nuclear powered engines are a light saw off and will need chemical boosters to get them in

the air, Crosby continued. Improvement of chemical propellant, Crosby said, will concentrate on solid. The energy of solid propellant, for example, must be contained. Heaters, burners and liners components are prime candidates for heat specific materials. Boosters has the edge on the other due to its higher energy potential and because more work has already been done on it. The trend, Crosby believes is from petroleum hydrocarbons to high energy fuels.

Propellant improvement

Value of the comparatively new, polybutadiene based (which also were in the field to improve solid propellant, offers no overall advantage over the petroleum elements favored by Thiokol. A major drawback to one of the polybutadiene as far as Thiokol is concerned, is its difficulty in controlling their rapid reaction rate although they are being used in boosters.

Thiokol also is using polymers of hydrocarbons and is interested in all new binder materials that come along. (Y-1) led Chemical & Die Corp., Avonlea, Wisc., learned in supplying materials which are reacted with alcohol to produce polybutadiene to both Thiokol and Avco-General.

The development of new solid fuels is an expensive gamble, Crosby pointed out. A company has to turn the propellant into the plant just days before it knows whether or not the new fuel is workable. Right now, for example, Thiokol is producing 10,000 lb. of each of a new polymer and, according to Crosby, it probably will be used this and in 1970 before it can be thoroughly evaluated.

He also declared that Thiokol is working on the development of plastic blast relief and outlet casings. The re-

Convair Space Plan

Washington—Proceeding from the line of generally based WS-177L-Fuel Plan, most Avco's location—Convair has proposed an early space program on a step-by-step basis Avonlea Work has been.

Step following 1974, would have a heavily equipped, equipped, and get into space to test the line of a global reconnaissance system.

After the global reconnaissance system would come a solid phase, a vehicle capable of going into orbit at a low cost, allowing a satellite low and high.

When problems of people in space have been resolved and effective satellite control, a series of supply facilities and other technology to be placed in orbit. Vehicles also would be used in assembling a space station on a step-by-step basis, under the satellite (intermediate) in target zone of the mission. A satellite capable of carrying vehicles would be used up that would serve with personnel on a regular supply and schedule.

From the space station open flight would be effected using an propulsion and other technology to be developed in open literature for a year or two.

Based on phase programs in place of solid fuel also means rarely from infrastructure systems, other than possible weight to step. The large solid rocket from the Nike Hercules boosters create a stable platform for the interlocking and interlocking of a stepped out circuit through the Avco has already selected missile flight paths.

On non-military markets for rockets, he cited production of solid propellant changes for use in modified existing rocket applications that at present, all such rocket applications are not considered by military agencies.

Indications are that Thiokol's new solid propellant rocket engine is being developed for use in the Avonlea RBM (now under study by the Air Force [AW FC] No. 10).

Top USIA spokesmen have referred to the new RBM as a successor to the WS-177L (Hawkeye) Dog as a surveillance satellite being developed by North American Avonlea, Inc. It has with the B-72 and as a third generation offspring from Bell's a three-stage Rascal now in operation with a Strategic Air Command B-47 group.

Combined with a multi-pointed booster, which could occur anytime for extended periods, the new RBM would give the United States a first hand to direct military force against even to Polaris-armed Soviet submarines.

USAF Plans to Study Moon Surface

Washington—Comprehensive planning for orbit projects, programs aimed at gathering data on Moon's surface and characteristics has been recently completed by the Defense Research Agency.

Known as Project Lunar-100, the first instrument Convair—the Road program encompasses one of USAF's Convair 440 instrumented rocket ballistic missile to orbit booster stage in the early stage rocket program. It would have a payload tone to facilitate production of the Moon's surface.

Information will be used to determine what instruments can be used for available in any future attempt to establish a base base with extensive facilities for both military potential and scientific exploration of space beyond the Moon. Scientists are not completely agreed on the composition of the Moon's entire surface and distribution. After several years of extensive reconnaissance, rock data and fragment deposits on the lunar "yema" got around from a few inches to several miles in depth.

Basic knowledge of the depth and related surface characteristics would facilitate establishment of a base base.

While full mission on the Moon probably will be made with a Douglas Thor RBM in booster because of its development schedule (AFR No. 28, p. 26), Atlas was selected for the booster stage in the Road Moon rocket program. Details required for the large combined period of instrumentation, guidance and control required for precise impacting of one tone of prepositioned speed and angle. Knowledge of these two factors will be essential in calculation of position.

For atmospheric of proper trajectory, after being released, guidance would control rocket position, its altitude and speed of descent to allow base base per second, it is reported. As the Moon is approached, observations will be attempted to determine to calculate time speed, which will be in line enough to avoid detection of instrumentation on impact. Reports also would be possible according to some project early steps.

Timing and location of equipment now in being could be modified to fit the long range reconnaissance requirements.



ERGUMENT missile is launched at ascent test firing at White Sands Proving Ground, N.M. Army sees missile guidance system as unreplaceable in entry countermeasures.

Solid Fuel Fires Sergeant Missile

Sergeant surface-to-aircraft ballistic guided missile with a range approaching 100 mi. is United States' first solid guidance tactical missile according to Army's management-led work. Sergeant will replace Corporal which has been operational for the last four years, has range of 75,000 mi.

Advantage of Sergeant over Corporal are said to be:

- Solid fuel. Missile uses a solid as fuel and motor of advanced design and increased specific impulse. Motor variables both storage and handling problems, improves resistance to fire, corrosion, shock and vibration for field use.

- Mobility. Missile is about 10 ft long but has been packaged as all section air launch for high portability and mobility. Besides down for transportation, missile can be carried in standard Army vehicles.

- Self-contained guidance. Guidance for the missile is a self contained optical system that gives also an indication to all known types of optical countermeasures.

- Reliability. Army says it has demonstrated missile's high degree of reliability in flight tests under all operating conditions. Tests, however, have been with prototypes. No production missiles will be available for one month.
- Workshop. One factor in the re-

duced performance of Sergeant not mentioned in the Army is the reduction in size and weight of missile as it heads that missile smaller and lighter missiles to even higher speed.

Sergeant has been developed for years in California Institute of Technology, Jet Propulsion Laboratories, the same group that developed the Phoenix WAC Corporal and Corporal and related to experiments with Area Ballistic Missile Agency in developing Jupiter C but a check and reliable launching rocket.

Production of Sergeant will be by Sperry Gyroscope Co.'s Sperry Electronics Laboratories, San Jose, Calif., where long lead time sub-systems are already in production.

NACA Budget Request Cut by House Group

Washington—House Appropriations Committee late last week cut \$2.5 million from National Aeronautics Administration's supplemental request for additional funds to finance air operations through the remainder of fiscal 1958.

NACA originally had asked for \$33.5 million in supplemental funds for additional construction and for salaries and administrative expenses

This was cut in November to \$18.8 million by the House of the Budget.

In cutting another \$1.5 million from the request for salaries and administrative expenses and \$750,000 from construction funds, the House Appropriations Committee last week charged that much of NACA's waste research into the overlap those of the military.

The Budget House also has lowered NACA's fiscal 1959 request from \$118.5 million to \$105.5 million. It has not yet been considered by Congress.

At hearings on the supplemental, Dr. Douglas and NACA Director Hugh Dryden reported that the \$13.8 million request would provide for their program.

- Personnel increase of 465. This provides for an expanded science team of 915 to be approved in July toward the total of 9,000 which Budget Bureau has approved for fiscal 1959.

- Rockets to be used in remote ranges of Midway Island Va., station \$7.5 million.

- Data reduction center at Langley Aeronautics Laboratories \$11 million. This new building would contribute to saving data-processing system for that center and transfer NACA's own computer facility to Ames Laboratory and to acquire funds for a third computer at Ames Laboratory next year.

- Installation of a dynamics system research airplane \$1 million. This is for installation of an airframe system on McDonnell F101 fighter and for matching ground test systems and supporting equipment to permit flight studies on various dynamic systems used on high performance aircraft and models for flight control, guidance and weapon aiming.

- Ultrahigh temperature materials facility at Langley \$2.7 million. This would consist of an air jet heated by an electric arc to atmospheric temperature of 5,000 to 20,000 F. for remote data-acquiring equipment and supporting facilities for specimen fabrication and analysis. It would be used to simulate the aerodynamic conditions encountered during the atmospheric phase of a long-range ballistic missile and to study the effects of such conditions on a series of configurations and materials to determine the most effective means of securing structural support.

Dr. Hugh L. Dryden, director of NACA, pointed out that NACA started fiscal 1958 with a \$13.8 million program and that the level will continue to decline from the present 7,915 to less supplemental funds are granted the 465 new employees are planned.

Ames, Langley, 175 Ames, Langley, 195 Edwards, Calif., High-Speed Flight Station, 12 and Midway, Sta. two, 2



Doak Readies X-16 VTOL For Ground Tests

Ground tests are scheduled soon for new Doak X-16 VTOL, which is being stretched down, was simply mounted ducted fan that can be tilted 90 deg. after vertical climb for transition to high-speed level flight. Ducted propellers are driven by a single turbojet, Locomotor 351. Data are obtained at altitudes after which elevator leading edge can be used with every new X-16.

designed by U.S. Army Transportation Research & Engineering Command, was also tilted and had horizontally a conventional wing, the operation allows carrying cargo and is parked. X-16 has 25 ft. span, 12 ft. length and 16 ft. height. Takeoff weight is approximately 2,700 lb., useful load 600 lb. Doak Aircraft Co., Torrance, Calif., is the manufacturer.

Strike Near, Sikorsky, UAW Agree

Bridgeport, Conn.—Eleventh hour negotiations between Sikorsky Division of United Aircraft Corp. and United Auto Workers Local 837 at Bridgeport Conn., produced a contract settlement, the same day a strike was to begin.

New joint contract was also made in Sikorsky last December, including a general wage hike from rate to 14 cents an hour. Other upgrading was in sick benefits and changes in overtime pay and vacation provisions.

Union dropped its demands for union dues, separately wage increases and 10% night differential on after UAW international representatives a long local fight concluding "it would be negative and disastrous to strike over unresolved issues like the 30% differential."

Sikorsky contract fight has been watched by aircraft industry, as an in-house election UAW and Industrial Union of Marine and Shipbuilding is a step to end industry-wide bargaining (AW Feb. 17, p. 26). Some charges, an end to merger of management and labor can be paid from Sikorsky negotiations.

Intentions of UAW IAM cooperation came in Sikorsky settlement. Union was close which allows UAW to reopen wage negotiations next year at same time IAM negotiates with another United Aircraft Corp. division Pratt & Whitney, Hartford, Conn.

Nick contract at Sikorsky runs for two years with wage increase in one year. About 4,000 employees at Bridgeport and Stratford plants are affected, but contract includes:

- Wage increase with group 1 employees was getting top hourly wage of \$3.81.

- Hospital benefits raised from \$12 to \$15 a day, with top hourly benefit for company and employee.

- Indefinite-term contracts rather on contract groups for all employees at Bridgeport and Stratford plants.
- Broadened number of areas leading to substantial and aided in contract wording on eight paid holiday days plus full provisions allowed the both now.

- Provision that strikers no longer must accept benefits they do not want, and agreement to 54 business day

but pay for employees during temporary medical work.

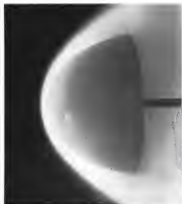
Employees said the settlement clause was enough to strike as is shift. Both sides apparently made concessions. Company local dues have decreased to limit pressure during period and extension of time for bargain in areas grievance.

Sikorsky had proposed an extra 200,000 contract clause but steps local union must accept increase in its operation groups from 49 to 100. Union considered this would be a cut in dues, etc. The rate at which hourly wages were paid "never" effect with less work from jobs. Union, however, agreed to addition of eight new jobs.

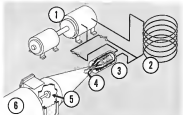
Union spokesman said new agreement clause allows union to file full grievances on 400 employees' dissatisfaction of department operations and on pension, benefits and job desk others. The latter was considered a major gain.

Sikorsky contract signing (reported by Local 837 with of 7:30 p. M.) led into settlement of strike in IAM Peoria plant Lodge 707 against Kallman's structural Corp. of Elmwood, N. Y. Company is active in Japan-C and VNA work, progress.

NACA Wind Tunnel Nears Mach 50



INCA/OSCAR receiving data from the tunnel test is carried in high velocity air stream. Flow test 1/10 sec. has created sharp vortices.



NOTES: (1) supply generator (2) feeds current to coil (3) coils to air chamber (4) and (5) coil. (6) and (7) supports at perforated insulators and air flow into test chamber (8) just test object in various chamber (9)

Wingspan—except velocity has been exceeded in a wind tunnel for the first time. Velocity achieved is almost Mach 50.

Author of 32,400 mph, with two-stage velocity exceeding 41,000 mph and pressure above 30,000 psi, was achieved for about $\frac{1}{16}$ of a second as subsonic flow and supersonic flow of electric arc tunnel Habitat II at Air Research and Development Command Arnold Engineering Development Center, Wallingford, Tenn.

553 large electric arc tunnel test area automatically full-scale model and speed-of-flight components in its final stages of design at AEDC. Some equipment for it already has been bought. It will be designated Tunnel I.

Habitat II's test section is 50 in. in diameter, large enough to hold very large scale model components. It is an outgrowth of Habitat I, which has a 16-in. diameter test section. The first tunnel has been in use for the past year and has tested scale models of the new series of the A-7B, T-19, Thor, Vulcan and other advanced missile projects.

The second test in Habitat II is approximately nine miles per second. Velocity required for an object to escape Earth's gravitational force is approximately seven miles per second.

Time Line

Length of test run is limited by materials and pressure that tunnel components will withstand without swelling or rupturing, but special superalloy construction developed for use with Habitat II record pressure distribution, heat transfer rate, etc., allow acceptable accuracy.

Both Habitat tunnels and Tunnel I are part of AEDC's Gas Dynamics Facility, one of three major laboratories there.

Habitat II not designed and constructed by ARD, but, operating contractor for AEDC. ARD also developed the instrumentation. Aero-Chalices Corp. developed the amplifier generator used to create the electrical charge that both tunnels and pressure arcs for the tunnel. Westinghouse Electric Corp. built the large solenoid coil which generates electric arcs for the test.

Arc flow is produced by discharging a powerful electric arc in a small chamber. Operation begins when the amplifier generator locally electric current to the solenoid storage coil.

A current in the arc chamber is closed while a magnetic field of sufficient strength is built up in the coil. When energy reaches the desired level, a circuit breaker in the arc chamber is pulled, producing the arc through an

instaneous collapse of the magnetic field.

Arc length or in the arc chamber and in a predetermined position and time position, a thin plastic diaphragm separating the chamber and the tunnel throat ruptures releasing the release into the main tunnel and test section. Arc diameter is in diameter. Air Council work of the tunnel expands from $\frac{1}{16}$ of an inch diameter at the throat to 36 in. at the test section.

Air pressure in the arc chamber is raised to 100,000 psi, just below 40 mg and air in the main tunnel is reduced to one-tenth of its static pressure.

Use of the storage coil eliminates the need for large amounts of capacitor used in Habitat I. The coil can store energy but voltages ranging from Mach 10 to Mach 30, instead has pressure of more than 15,000 psi and pressure above 28,000 psi.

Construction of Habitat II began in the spring of 1955. It has been under development for the past year. As Flat shot II goes into operational service for Air Force, Navy, Army and industry contractors, Habitat I will be used for further testing and being in development of Tunnel I. Habitat I will be built under supervision of the Army's William Daniel Kayser.

Length of the test run in Habitat II is substantially longer than made in other tunnels in this speed range. Air Force and pressure and test program produced for several hours exceeded in other tunnels.

Canadair, Lockheed Order Fairchild J83

New York—aircraft J83 light-weight biplane was ordered by the Government of Canada, an C-41 subsonic jet fighter on flight test program by 1958. Contract now for 145 units for the 2,000 lb thrust J83 which will power the new Bell Canada aircraft for the Air Force.

Canadair designed in C-41 to receive several types of small U.S. and foreign turboprop including General Electric J83, indicating that a major order has been placed by the U.S. for a turboprop engine. The turbine manufacturers will probably get delivery orders in the next few months of specifications as the J83 shows it to be approximately 37.5 in. long and having an 18 in. dia.

Lockheed has decided to order a small number of J83 for propeller test and evaluation in the jet engine flight program. The two-engine J83 has been tested with the two engines. The engine is a two-stage turbo-propeller engine, the engine is a two-stage turbo-propeller engine, the engine is a two-stage turbo-propeller engine.

Executive Scores Arsenal Concept

New York—Application of the Arsenal concept of development is a complex weapon system that aircraft and missiles is "unobtainable" the product of North American Aviation.

L. J. Arnold, speaking to the New York Section of Society of Aeronautics and Astronautics, said he would like to develop the Arsenal concept with respect to complex systems. He said the development of Arsenal is a major step in the development of the Arsenal concept, but he said the Arsenal concept is not a simple concept.

He noted the present competitive nature of the Arsenal concept is not a simple concept. He said the Arsenal concept is not a simple concept. He said the Arsenal concept is not a simple concept. He said the Arsenal concept is not a simple concept.

The industry Arsenal continued to be developing Arsenal, but he said the Arsenal concept is not a simple concept. He said the Arsenal concept is not a simple concept. He said the Arsenal concept is not a simple concept.

Arnold closed his speech by saying the Arsenal concept is not a simple concept. He said the Arsenal concept is not a simple concept. He said the Arsenal concept is not a simple concept.

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Turning to North American's operations, Arnold said the company now has 49,000 employees, a reduction of about 22,000 persons over last year, he said, which will be a major step in the Arsenal concept.

Arnold stated 1958 sales of \$710 million and said he is confident North American will get back in the better color side line although it may be some time before we can expect the return to 1957.

He predicted an improvement in company's Los Angeles Division will continue downward in 1957 until production starts at a 100% capacity as forecasted and 0.81133 weapons as item was in competition with Boeing Airplane Co. Arsenal and then also as "possibilities" for Submarine force and other construction in Arsenal concept. Los Angeles Division has been concentrating on F-100 program.

At Columbia Division, Arnold stated that North American's 10,000 production has concluded on F-100 and Navy contract for F-104 fighters will be completed this summer. Defense is producing F-104 for Navy and is developing M-1 carrier-based aircraft.

Company employment was severely curtailed at Mobile Development Division, Dallas, Calif. where North American is producing 10,000 production has concluded on F-100 and Navy contract for F-104 fighters will be completed this summer.

North American has also shifted production of Arsenal at Dallas. He said the Arsenal concept is not a simple concept. He said the Arsenal concept is not a simple concept.

Continued growth at Rockwell Division with plans of Georgia Tech, Calif. and North American is continuing development on Arsenal and other projects.

Continued growth at Rockwell Division with plans of Georgia Tech, Calif. and North American is continuing development on Arsenal and other projects.

News Digest

Fast Pacific Seaplane of 1951 design, 100 mph, U.S. 50-craft (1st) Pacific Seaplane 154, which is assigned the aircraft is delivered ahead of the U.S.S. Harrier, intended for duty with the Pacific fleet.

Jet aircraft which refueling has been carried out for the first time, in concept. The aircraft is \$2,400,000. The aircraft is a C-124 of the Light Refueling Co. Vehicle also is undergoing test to check handling characteristics up to Mach 0.7 and flight tests with different wing loadings in clearing North American aircraft are also.

CAA Wins Battle for Airspace Control

New office is created to allocate airspace as climax of bitter civil-military dispute; Quarles letter a key.

By L. L. Doty

Washington—Civil Aeronautics Administration last week took final steps toward implementing its new scheme to control all U.S. airspace.

Congress has approved military civil and military aviation for America's rapidly disappearing airspace. Civil Aeronautics Administrator James T. Pils Jr. announced the creation of a new office of airspace administration at Washington with Harold Nogge as its head. Under Pils's jurisdiction and subject to a review by the Civil Aeronautics Board, the new office will be responsible for the allocation of all aviation airspace, prohibited and otherwise, to military and commercial users.

Relief giving CAA control of all airspace becomes effective in April. "Nogge, who has been with the CAA since 1946, was assigned general control for the agency prior to his present appointment. Eisenhower B. Northing, chief of the Air Force Civil Branch of the Office of Air Traffic Control, has been Nogge's deputy.

The action represents a victory for civil aviation because military has for more than a year, had virtually protested military expansion of large blocks of airspace as off-limits to non-military aviation.

Defense Protest

Delays, Department protests at the proposed transfer of control at Washington to take in full effect (AW No. 4, p. 57). In a central response to the Board's draft action covering the setting of the Defense Department challenge of the legal title of the CAA to control airspace. It also questioned the evidence of airspace in the case of an engine.

Later, Defense Department has called a meeting held in Washington on Nov. 6 by the Board as a means of breaking the deadlock through a detailed discussion of technical problems involved. On Feb. 7, the aviation authorized and in a letter to the Board signed by Deputy Defense Secretary Donald Quarles told, "It is the view of the Department of Defense that the Board has appropriate legal authority to meet this challenge."

Some observers attribute this reversal of position to an earlier letter, also signed by Quarles, during an on-

fact between military and civil flight rules in the mid-air collision between an F-105 and a DC-7C near Van Nuys Calif. on Jan. 31 (AW Feb. 11, p. 75). The letter, which came to light during a review of military operations held for the agency, contains a partial list of responsibilities of a traffic control in the Civil Aeronautics Board.

Letter to Kuchel

Addressed to Sen. Thomas H. Kuchel (R. Calif.) in response to a query as to whose responsibility, related to controlling the two aircraft, the letter laid to part in planning flight through airspace above the continental U.S. as to locations and positions, the military departments recognize and comply with the rules promulgated by the Civil Aeronautics Board under the authority contained in section 603 of the Civil Aeronautics Act of 1958.

The new ruling will strip the Air Coordinating Committee's Airport Use File of all authority to make a final allocation of airspace. However, under Rules Committee plan the

panel will advise and advise all in-quests by airports from both civil and military aviation groups before they are forwarded to Nogge for review.

An earlier report will be reported by the CAA to each class of the agency's air traffic control control centers throughout the U.S. One of the functions of this separation will be to verify the installation of appropriate flight instruments.

Congress will be referred to CAA regional offices by the supervisor for review. Public hearings will then be held in the area. Airports Use Panel and findings will be forwarded by the Airport Use Panel in Washington. Final action will be taken by the new CAA airspace office there, both civil and military, a strong group will have an opportunity to be heard on any application for separate allocation or on conflicts over present assignments. Both existing airports and new airfields by the military service will be the Civil Aeronautics Board under the authority of section 603 of the Civil Aeronautics Act of 1958.

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In writing the ruling, the Board recognized that, under certain circumstances, it may be necessary for the military to conduct operations that can not comply with the Civil Air Regulations. As a result, the regulations provide for military aircraft to operate from civil air traffic rules when appropriate military interests determine that non-compliance is required by military operations or critical military interests controlled by the Defense of the United States and prior notice thereof is given to the administration.

'Non-Compliance' Protest
It is the non-compliance action which is the main complaint of action of the ruling that does, some, would you both from civil aviation groups who otherwise strongly supported the action. Milton W. Arnold, Air Intercept Unit vice president, complained that the ruling did not make it clear that the CAA investigate methods or procedures by which the Board can establish the non-compliance of the exception by the military.

An Air Force White Paper expressed views for doubts and charges that military control spots has been and will

continue under certain specified conditions during certain hours of the day. The pilots' group called for an investigation of the type and amount of usage of restricted military airspace.

Most observers are not, however, that the requirement of prior notice of any deviation from air traffic rules will eliminate airspace conflicts that could threaten an aircraft. Past an aircraft could not specify conditions under which military aircraft could deviate from air traffic rules.

In addition, the Board has considered that the intent of the new ruling is to conduct most military flights such as training operations under the terms of a waiver issued by the administration and not under non-compliance authority. The Board explained that the rapid increase of air traffic at all types

has "created increasing problems in resolving conflicts during certain hours of the day."

The problem of maintaining an open lane has become so acute that the government has no longer accountability of the needs of individual users without inherently violating the interests of all users to determine what is best in the public interest.

Right Safety

Under the regulations the Board delegates authority to the administrator to designate restricted areas whenever operations are considered necessary to the conduct of aircraft in flight. The administration also may require such operations and limitations at any time deemed necessary, and may modify or revoke such designations when required in the public interest.

Engineer Hearing Main Issues Delayed

By Glenn Coxson

New York—Development of the new main rule for the design of engines for New York-Europe International and Eastern Air Lines are postponed last week when an engineers board hearing the case advanced until Feb. 27 and shifted the locale from New York to Miami, Fla.

During a week of testimony before the engineers presented part of their case but have not yet heard oral testimony for a job agency's contract classifying FAA's design engineers in future contracts, or into their present status.

The three-man board, with Air Line Pilot Ass'n's overlapping dispute with Eastern still to be heard, held the hearing on the case in Miami, Fla. The board's approval of a 30-day extension for filing a report. The extension board, set up Jan. 25, had 26 days in which to file a report.

FAA continued to act as a mediator in the case, as has been done in David L. Cole, chairman, Sam Waller, and Dudley Whiting.

Engineer's Evidence

During the New York session the engineers sought to establish the present and future need for professional, non-engineered flight engineers as transport aircraft crews. The union wants Eastern to agree to a contract classifying flight engineers as pilots and flight engineers on a separate but provided for in the agreement to be used on all flights of aircraft of over 30,000 lb gross weight and on all other flights on air service and in which a flight engineer is used by the transport operator as required for governmental regulation.

Cole suggested that the engineers

continue around it showing that the flight engineer is essential and will be used more as it gets held up by the FAA's contract dispute. The FAA did, however, ask that the wage dispute, Cole, said.

George R. Perry, Jr., president of FAA, described in oral the flight engineer's role in jet and turboprop operations. The engineers contended that jet operations will be more complicated than piston planes and will require greater skills from the flight engineer.

Perry also presented testimony from pilot James G. Hester, FAA's chief pilot and Boeing had advised him that the flight engineer's job as the 707 gets underway, "a greater technical background than is required in piston aircraft. Hester contended that procedure and later testimony put out by the jet manufacturers stressed their complex jet complexity.

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Flight Safety

The 1954 paper predicted that the flight engineer will become a requirement in the design of jet flights and "because" some current engineers' job of the flight engineer, according to the exhibit, was at first primarily physical—the simple aspect as another pair of hands for the pilot. This view was not shared, but paper said, "As time goes on, the pilot will require to operate power plants and systems, but some of their functions will be

The Board ruled that the administrator will comply with the provisions of the Administrative Procedure Act in revising the engine authority. The rule will allow all interested parties a full and complete opportunity to participate in all the steps of the process.

In addition, the Board reserved a right to review—in its own administrative action files—in the administrator. Final appeal from an decision taken will be the White House.

In going on the legality of the ruling CAA general counsel Franklin Stone based on legal law in the original and concluded that "no one can be arbitrarily confined under all circumstances of the law, and that the law and operation to resolve the dispute must and then to accept it to the exclusion of all others, it must be accommodated to the extent possible."

Engineer Hearing Main Issues Delayed

related operations and tested more and more heavily by the engineer. In jet operations, the contribution of the pilot is to monitor the cockpit and

Besides the quality of the flight engineer's experience working conditions was a major part of the FAA's position. John J. Reber, chairman of Eastern's chapter of the union, was the chief witness in the case.

Hearing Issues

- Among the issues covered in this hearing were:
- Flight hours per month—FAA wants a guaranteed minimum of 70.
- Deadheading—the engineers want full pay instead of half pay when deadheading up to these assignments. They also want "dead" pay for "positive" reservations on the last available flight as a captain deadheading back from a flight. Eastern says, according to the testimony, presently involves working with a contract of 30 and sometimes leaving space to reserve passenger seats.
- Time off—engineers seek four work stations, minimum of 30 hr off duty before start of a month, at least one of 45 consecutive hours of each month.
- After the board had the balance of the engineer's proposition and Eastern's response, the pilots' case will begin. The ALPA Eastern fact finding committee has some areas before the present case was set up. On Feb. 25, Eastern an extension of test will be required in this report, too, as ALPA's case will hardly have begun at the end of the report, but paper said.
- The engineers are seeking an average pay hike of 13%. Eastern offering 9%, then said up to 7%.



Tu-114, with one engine being overhauled, is parked next to An-12 Embler at a Krasnoyarsk airport. Tail of the An 12, a four-engine turboprop designed for Aeroflot's rough field landing operations, shows obvious cutbacks in an endeavor to solve a structural stability problem. Heavy truck under nose of Tu 114 is typical of ground loading equipment at Krasnoyarsk airport.

First Flight Photos of Soviet Tu-114 Turboprop



Tu 114 and other new Krasnoyarsk turboprop-powered transports and the technology behind them have been described by Donald Douglas, Jr., in a seminar aimed to present U.S. position as top world supplier of commercial aircraft. The 11,000-sq-ft Krasnoyarsk K-12 engines which power the Tu-114 probably represent the greatest USSR's lead in the transport field, as the West has no similar engine.



Flattened nose of the Tu 114 indicates that the aircraft has greater lift than wing carry as the Boeing 707 and the Douglas DC-8. However, the Tu 114's wing appears to have a higher aspect ratio which would make it more efficient for long range flight. These features are looked on with skepticism to reduce the spurious flow. Note change in taper ratio.



Spacious dining accommodations are feature of Aeroflot's Tu 114 service. Tables can seat six persons easily before, left. At right, steward serves and that prepare snack trays in aircraft's galley. Restaurant design has right tables.

He does the mile in 7.4 seconds ...so you can do it in 6!

His name is Andre Leriche. He's just pushing 30. And he hasn't run a mile since his school days. But he's down many millions of miles...at the controls of Air France airplanes. Doing the mile in 7.4 seconds is just routine for Andre. It's the average cruising speed of his Caravelle jet. Soon he'll be flying a six-armed jet across the Atlantic (and you can, too!) in new Air France Boeing 707 jet airplanes! Captain Andre Leriche has over 30,000 flying hours, over 120 Atlantic crossings to his credit.

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AIR FRANCE/WORLD'S LARGEST AIRLINE
11117 Zouaves on Air France airlines arrive or depart



AIR FRANCE



RIGHTS for turbo-prop 1135 Motors. The new plane which is scheduled to go into regular service after the end of a long test in a section of the factory formerly used for constructing two-engine B-14.

Il-18 To Fly Moscow-Vladivostok

Moscow—Constructing its new jet plant on the long operating coast Russia state-owned airline Aeroflot is now looking beyond the Tu-104 turboprop transports for a more economical airplane to serve its long-haul trans-Siberia routes.

With traffic rising spectacularly all along the Far Eastern coast, the Soviet airline plans to rule the Il-18 Moscow-Vladivostok route service by summer of late fall. Aeroflot's official point out that the Il-18, which will be built in 75 and 100 passenger versions, can fly from Moscow to Vladivostok at half the cost of the 50-passenger Tu-124.

Low Cost

A notable saving rate of low operating costs has been planned by the Russians on the Tu-114 turboprop transport (AVT Lab 17) p. 30.

Cruising speed of the Il-18 is about 400 mph as compared with 320 mph for the Tu-104 and 400 mph for the Tu-114. However the Il-18's weight has a 3,000-kg maximum single seat on under the Vladivostok run with only one stop compared to a maximum of two for the Tu-104.

If success, the Il-18 will take off or land at an Siberian 6,000' airports, eliminating the time-consuming engine 114.

The Tu-104 requires considerable large airports.

Route Check

On a Moscow-Vladivostok, proving run last month, a Tu-124 covered the 5,000 mi in seven hours, 35 minutes flying time. It made stops at Dard, Irkutsk, and Khabarovsk. Scheduled runs of the Il-18 will be about one hour longer.

According to Russian sources, high operating costs of the Tu-104 would be intolerable if Aeroflot's trans-Siberia traffic had remained at the present

level high volume of three years ago. But both cargo and passenger traffic between the Far East and Moscow is climbing rapidly.

Complete traffic statistics are not available. In 1957, however, about 25,000 foreign passengers also stopped at the coastal Siberian city of Irkutsk on Aeroflot flights as compared with only 5,000 in 1951. Most of this is seasonal traffic was handled by the new Chers' North Korea Government Vot Nara and Bama.

Construction of the large, fixed hydroelectric plant near Irkutsk, members of the United Nations, increased between oil gas and aerial prospecting and large-scale fur trapping have added to Aeroflot's Far Eastern traffic losses.

Decline in Passengers Continues in January

Washington—Passenger load factors on domestic airlines continued to decline in January following a downward trend that began almost two years ago.

Revenue passenger load factors for the nation's January operations dropped to 78.9%—a decline of 1.1% percentage point from January, 1957. Monthly load factors have shown an average over corresponding months of the previous year since that time in the past 23 months.

However, the January load factor represents a recovery from a decline experienced by the industry in November when the load factor fell to a low 75.2%.

Available seat miles continued to rise spectacularly, and, for the 12 months ended in January, passed the 40 billion mark for the first time, a 17.7% increase over the same period in the preceding year. During the same period revenue passenger miles increased 17.0%

to reach an all-time high of 24.6 billion.

Revenue passenger miles for January totaled 2.66 billion compared to 2 billion in December and 1.79 billion in November. Available seat miles in January rose 157 billion, a 12.2 increase over the previous January.

Concession Contract Given to Interstate

Los Angeles—Board of Airport Commissioners of Los Angeles, after three and one-half months study, here has awarded lease and operating agreement to Interstate for the International Gateway, a new wide, modern and efficient terminal to replace the antiquated and increasingly crowded hangars and new terminals in the new Los Angeles International Airport (AVT Div. 2, p. 41). The move by the Board of Airport Commissioners directs the Department of Airports Management to draft a lease and operating agreement with Interstate. After the commission approves the lease, it will go to the City Council for approval.

Interstate also has proposed in Chicago proposal to pay for Los Angeles Department of Airports 10% of gross foot miles, 10% on "en route" domestic because, 10% on "off route" border lease and 12% on new-growth items. The company offers a maximum guarantee savings from \$700,000 in the first year to \$1,625,000 in the 10th year for a total of \$17,075,000 for the 30-year period.

Interstate also proposes that all points in excess of 80% on gross revenue be divided equally between the city of Los Angeles and Interstate. As part of the proposal, Interstate will move its corporate headquarters to Los Angeles within 12 months after signing the lease agreement.

The company says it will invest in a total of \$10 million and \$3 million for signposts and level-hold signs, including terminal direction. The construction contract will include construction, installation, and maintenance of the 275,000-sq-ft building, air side, the existing hangars a "five flag" cockpit and fuel facility, an engine exhaust and an airframe new-growth stack.

Other firms that submitted proposals were, Hutton Hutton Corp., Ford Harvey Co., Union News Co., Sports Service Corp., Airport Commissioners Inc., Paul S. Conroy (Hendrix, Reston, Harris) and Rexell Thayer.

Interstate also has a long operating agreement with San Francisco International, Sacramento Municipal, Charles Lee, W. Va., airport, Detroit, Wayne Major, Nev., Gilroy Municipal, plus gift shops in various other airports.

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VICKERS LOCAL SERVICE VISCOUNT

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Pan American Markings—Old and New

The American World Airways is replacing more than 100 aircraft and hundreds of ground service units to what company calls its "New Look." New paint jobs shown on three new Super Stratliners at New York International airport, but light blue show existing length of white leading edge. Pan Amcoons' livery is black above windows. Tail is painted with 3-11 Air, blue globe with "PanAm" in white.

BOAC, BEA Overlap To Beat Competitors

London-Brussels-Dublin Airways Corp. and British European Airways have signed an agreement offering them to operate on each others' routes. To compete with foreign airlines BEAC will operate through an agent in Europe. In return, BEA will be allowed to expand its services to Great Britain and Ireland. BEA will also operate services on the Persian Gulf on behalf of Cyprus Airways.

The airlines said it had now become necessary for BEAC to step up its activity in Europe, but that it did not want to depress BEA's operations. "BEAC is given temporary facilities in some respects but BEA should be given the opportunity of obtaining an equivalent amount of work outside its own territory," a joint statement said.

The new deal entails for BEA's expansion the extension, added, of the company's routes to the Mediterranean, and several branches for extending its routes to southwest Europe were provided by Beirut, Tel Aviv and Cairo.

In the past, as it was noted by both airlines, some specifications on common ground has been posted.

George Giles Named Riddle Airlines Head

Miami-Riddle Airlines, Inc., directors have elected George L. Giles president to succeed John Paul Riddle, who becomes chairman of the board.

Speakers for the airline had no explanation but said it was the change was made but said a statement would be forthcoming shortly. The airline's current has been experiencing 5

several troubles in developing new routes awarded in 1956 to the Civil Aeronautics Board.

For the first year ended June 30, 1957, Riddle showed a net operating loss of \$1,011,351 on revenues of \$11,170,547 following an agreement to discontinue of the new route pattern (AW, Nov. 20, 1956, p. 41) traffic failed to meet expectations and had December the services related to merged services temporarily at Boston, Philadelphia, Jacksonville, Cincinnati and Cleveland. No action has been taken by the CAB, and Riddle now is filing

an appeal, a week to these provisions demand trips.

Last fall the carrier sought to increase its common stock from 75 million to 11 million shares. Ransom still is before the Securities Exchange Commission Arthur Young Davis, owner of 51% of Riddle stock, has advised \$1,000,000 toward per cent purchase of new shares.

Giles' post recently changed in his name in Puerto Rico from 1952 to 1954 was general representative of the Securities of Defense in airport construction work for NATO.



Model Shows VC-10 Slots

New photo of model of Vickers VC-10 long range jet transport shows mounting of four Rolls-Royce Conway engines at tail with propellers. Also visible is radius of tail span leading edge ribs and flap and spoiler on trailing edge.

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SHORTLINES

► **Allegheny Airlines** reports that it flew 77,011,000 revenue passenger miles last year. The airline registered a 135% increase in air freight and a 23% increase in air mail.

► **British Overseas Airways Corp.**, which recently awarded its first anniversary of Boston-Britain service, says the turbo-prop transports have carried north 77,100 passengers and flown some eight million miles during 25,300 hours on its exclusive morning service. First British service was to South Africa. U.S. service was begun a few months ago.

► **Carl Airlines** Board has granted Frontier Aeronautics Corp. an option permitting it to operate transoceanic cargo charter flights in foreign air transportation between Alaska, U.S. and Anderson, Ind., and Oklawaha, Fla., Canada west November.

► **Delta Air Lines** reports that revenue passenger miles last year showed a 16% increase over 1974, resulting in a passenger load factor of 57.75%. Cargo revenue also increased 16%, but net earnings rose down to \$289,000 as compared with \$791,138 earned in 1974.

► **Irish Airlines** is scheduled to begin transatlantic service on April 13 using three Lockheed L-1049H Constellation leased from British and Western Air Lines. The Irish carrier will operate three flights a week at first, increasing to daily flights as the summer tourist season commences. The flight is an operation between New York and Shannon and Dublin. Henry W. Held has been named vice president (U.S.A.) to handle sales and administrative and will locate in New York at the Irish Home, 31 E. 36th St. Held was formerly traffic and sales manager for LAA—the Venezuelan Air Line.

► **East Central Airlines** served 364,073 passengers, 23,171,750 revenue passenger miles during 1975, up 17% and 31% respectively over 1974. Passenger income rose up 73% to \$1,573,205.68.

► **San Jose International Airport**, Puerto Rico, handled 985,010 passengers during 1975, a 15% increase of 132,564 over 1974. Revenue air cargo registered in 1975 to 41.6 million lb., 23% above the 34.2 million lb. handled in 1974.

► **United Air Lines'** directors have elected a quarterly dividend of 124 cents per common share, payable March 15 to stockholders of record as of Feb. 14.

AIRLINE OBSERVER

► Airlines are pushing for a better sound of labor negotiation this spring as unions begin to hit the ground, but new demands tend to be the question of jet transports. One union, Eastern, already has met to meet other negotiations with three of its unions—Air Line Pilots Ass., Flight Engineers International Ass. and the International Ass. of Machinists. The latter union has set a March 2 strike date against both Eastern and United. Western and American are involved in emergency proceedings with ALPA in last-ditch attempts to stave off strike. Strife threats will undoubtedly increase this year since airlines, caught in a profit squeeze as a result of existing expenses, will not be in a quick-to-compress as they have been in the past.

► **Finnair** has agreed to review discussions pertaining to its bilateral air agreement with the U.S. and talks are scheduled to be resumed in March. However, most observers expect that Finnair will be one of a U.S. airport that talks rights to Finnair be relinquished as exchange for a route to the West Coast (AW Feb. 17, p. 25).

► **Carl Airlines** Board has revised its decision to tighten restrictions on other, less-past practices. The Board's original decision last fall was to place a new interpretation on the section of the Civil Aeronautics Act governing line air transportation that would prohibit from other airlines, specifically through the airlines (AW Dec. 30, p. 14). The Board now admits that many of these practices are of long standing and some of them appear to have become embedded in the industry's labor relations structure. Current interpretation of the law will be suspended until Sept. 1 to give Congress an opportunity to consider the five past practices.

► **Boomer Air Lines** has asked the Civil Aeronautics Board for a guarantee of a \$4.5 million loan from the First National Bank of Nevada at a 5 1/2% interest rate for 10 years. The loan, to be granted under the recently approved Equipment Guarantee Loan Act, will be used for the purchase of six Fairchild Friendship F-27 turboprop transports.

► **Port of Portland (Oregon)** has demanded the removal of Air Force inter-upter operations from Portland International airport. The Port claims that the airport's air and development has no purpose will be critical in long as inter-upter operations continue. It also claims a proposed side corridor connecting Greater area jet flights from greater commercial aircraft would cause "mass flight delays thus over the Portland area."

► **Air India International** technical mission, headed by the airline's general manager, is talking with another representative in Moscow on the possibilities of an air agreement covering direct or service between Moscow and New Delhi via Kabul. Discussions between the two airlines are the result of an invitation extended to India's national airline by the Russians.

► **Railroads** may be expected to cut freight rates in a move to recognize their lesser share of the nation's freight market. Freight traffic volume has declined steadily during the past decade and rail officials now feel that the loss can be attributed to the consistent climb of freight rates since 1945. Although initial rate cuts will be confined to a limited number of commodities, the revised rate structure, if successful, may be expanded to cover a wide scope of shipments.

► **Edo Airline** Loran has been selected as a local freighter-transportation system for multi-operations transports by Pan American World Airways, Qantas, British Overseas Airways Corp. and Oklawaha Commercial control and through-ship scope of the Edo Loran equipment scope are outlined in the cockpit for pilot operation.

► **American Airlines** is introducing a telephone system of allowing travelers to large area of transportation. Telephone is connected with a remote facility to accept a continuous status port ticket lines. However, located in the company purchasing the transportation, Texas Light transport for the passenger "soft fare" program to be returned to American with payment and a coupon for the purchaser's record.



45 TONS PER HOUR—In northern Norway, pilots of the U. S. Army's 6th Helicopter Battalion carried loads of building materials, steel, electronic equipment, and even dynamite to mountain-top sites of micro-wave relay stations. The HO4S-1 (Sikorsky S-56) delivered their cargo at the rate of 1½ tons every 2 minutes.

AROUND THE WORLD WITH SIKORSKY HELICOPTERS



LIFTING THE LANTERN—An HO4S-1 (Sikorsky S-56) from the Second Marine Aircraft Wing places a 1100-pound lantern atop a new 140-foot lighthouse at Cape Fear, N. C., with only 8 inches of clearance on the sides. Hovering stability for this difficult job was provided by Sikorsky's Automatic Stabilization Equipment in the HO4S-1.

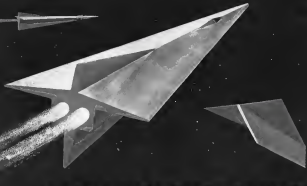


52 RESCUED—The crew of the grounded French freighter *De-Me* were flown ashore near Casablanca, Morocco, by an HO4S-1 (Sikorsky S-56) of the Air Force's Air Rescue Service, which is on duty around the world. All 52 of the crew were rescued. The HO4S-1 came from the U. S. base at Port Lyautey.



MORE S-56s FOR CHICAGO—The efficiency and convenience of helicopter shuttle service between Chicago's airports and the Loop area have meant vigorous growth for Chicago Helicopter Airways. The line has added two more Sikorsky S-56s to its fleet, for a total of five of these craft. The S-56 is the largest and most versatile helicopter in commercial service anywhere in the world.

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WEDGE DRAGED Earlier in this year's conception of a high-speed, dog-delta hypersonic aircraft, a flow field which greatly increases lift by moving the positive pressure under the wing. This configuration is distinct from the diamond shape suggested by Anton Fiesl (seen right) in which the flow field from the fus-

lage covers the complete under surface of the wing. Lifting and low speed flying would be problems on this type of aircraft. One seems to see leading gas dynamics could be a positive part of the result of the better technology, it will be done with respect to that of the North American X-15.



ARTIST'S conceptions of how a pointed aircraft might use reflecting planes to reflect wave drag. Flow fields originating on the forward wing surfaces would be reflected against the rear surface and produce thrust. Possible planes reflecting waves would approximately define only Mach 10 region to keep the proper spacing between the surface and the aircraft.

Radical Configurations May Find Role in

By J. S. Betts, Jr.

New York—Wedge shaped forebodies and tapered and tapered wing arrangements may be used at hypersonic speeds as those that might be attached to reentry from space, to ease lift-drag ratios to acceptable values.

Drag of subsonic hypersonic flow fields which can be controlled up to Mach 2 by the nose cone, becomes essential in hypersonic flight that radical departures from current aircraft shapes may become necessary.

Meat Fares

A large number of theoretically ideal aerodynamic forms are possible, but their actual usefulness will depend on how much they will have to be compromised at meeting the heating, structural, stability, and other requirements of hypersonic flying. They offer a starting point for strengthening hypersonic and high supersonic aircraft proposals.

However, establishment of the overall viability of such proposals will have to wait until they are flown or simulated.

More complete design knowledge is available concerning behavior of structures at very high temperatures and the action of the atmosphere when proposed for a hypersonic body.

As all the answers to these basic questions will not be available for many years it is probable that the first vehicle capable of Mach 10 and better will resemble present configurations configurations to a great extent, but as

knowledge and materials response to hypersonic aircraft could approach the asymptotic ideal.

The success and economic feasibility of rocket powered boost glide aircraft and other more carrying hypersonic vehicles depends to a great extent on the basic drag reduction work now being conducted by government laboratories and private firms.

In contrast to the subsonic work, wings and forebodies are much studied separately because the interference drag between two bodies in supersonic flow can easily double the drag of the bodies when considered alone. The height point in the picture is that these interfering shock waves and flow fields can be arranged so that they cancel each other completely and dramatically reduce the wave drag due to the bodies to zero.

Original suggestion that supersonic flow fields could be canceled and the thickness drag eliminated was made by A. Haumann at Rome in 1945, when comparatively few men were working on high-speed flow problems. This



SMALL VALUE of angle (A) is necessary for low supersonic drag. Angle (B) and drag are both minimum for given length when maximum thickness is at trailing edge.

Push Toward Space Flight

In 1977 C. Fiesl expanded basic research preparation to the three-dimensional case.

Today a large number of researchers are active in the U. S., some of whom have been studying the field were the Thermo-Propulsion among these men is Anton Fiesl, who is now at the Polytechnic Institute of Brooklyn and R. T. Jones of the National Advisory Committee for Aeronautics. Others who have contributed significantly to drag reduction knowledge are R. T. Whitcomb with the Langley Research Center, Max Henschel and Hansert Lorenz who worked with similar ideas around Mach 2, and A. J. Eggen, Jr., and H. J. Allen at even greater speeds. All these men are with the NACA.

Many contributions have also been made by scientists. For instance, one of the most important mathematical tools used in high-speed studies today originated with W. D. Hovav in 1947 when he was with North American. Much research cooperation effort is directed toward reviewing and compiling the output of theoretical investigations.

The object is to prevent the information on the most practical means for the achievement faced with the compromise of design work. A presentation of the kind that is useful with reference to it is the Douglas Aircraft Report No. NAC 19151 in four volumes headed by E. W. Gibson.

Mach 3 Wave Drag

Basically, two approaches are being investigated to reduce wave drag above Mach 3.

- Contouring and arranging the pressure drag and both to produce free shock interference and pressure fields. (Aerodynamic no longer applies.)
 - Using shock surfaces to cancel shock waves and flow fields from the primary body. (Shockwave principle.)
- Probably the most interesting work published available on the principle is cited in both of these methods has been written by Antonio Fiesl.

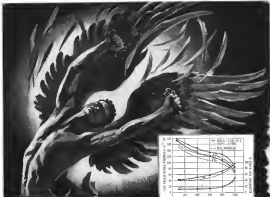
Contouring and arranging a fracture, wing and superwing for very high Mach numbers have an resemblance to today's air side. The aircraft is a vehicle.



FLOW INTERFERENCE can be created by surfaces and bodies placed in the envelope shown above. Interference is created by forcing the pressure both around and driving over Mach cone. Flat surface above generates lift because flow from pressure both goes at an angle of attack. Surface also reflects flow into the rear portion of the primary body giving it thrust.



ELISEMANN explains theoretically how wave drag due to thickness. Flow field from diamond portion of each wing is interrupted by the parallel rear surface of the opposite wing. Pressure on all surfaces is then equal and there is no drag.



FROM ICARUS TO MACH NUMBERS:

High-flight fasteners have come a long way!

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In addition to the high tensile strength, Ti-155A also offers good impact strength, ductility and fatigue characteristics. Its shop practices have been well established and Ti-155A can readily be formed in many reductions.

The result is an outstanding material for fasteners, fittings, extrusions, wire, rolled shapes—any place where a strong, light-weight, low and fatigue stack is required. It's readily available in conventional quantities—at prices competitive with other common heat-treated metals.

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TIMET

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STAGED AIRCRAFT PROFILES made by Antonov Five is shown above in an actual conception. Dr. Fren believes that multi-stage or multi-wing air-lifting systems will be one conventional thin rocket-powered launchable aircraft over great ranges. Large first stage aircraft would accelerate the second vehicle with the gas load to supersonic speed and a high altitude. The second stage would use liquid air and the first fuelstage. Space between the stages would be optimized for best drag reduction at some speed below separation speed which would afford the greatest acceleration and altitude fuel load.

or cross-sectional area will reach a cross section near the tail, instead of several the center of the fuselage. The wing and body will both have blunt bases or trailing edges as close as the neck of Dion R. Chapman of the NACA.

He demonstrated that wings and bodies with the point of maximum thickness at the leading edge had less wave drag at high Mach numbers. This is because separation wave drag is very sensitive to leading edge shape.

Thin leading edges might form a wing of given chord or a body of given length, a surface that at the point of maximum thickness is at the trailing edge. The wing therefore would be a wedge and the body of an-shank would be a cone. The basic pressure drag of these blunt shapes was shown to be much smaller than the drag wings would be the maximum leading edge angle.

Wedge Wing, Fuselage

In arranging such components for maximum drag Tim has suggested a wedge-shaped wing with a wedge body completely below it. The smooth cylindrical configuration of this type is in its accompanying sketch. In this arrangement pressure field created by the wedge fuselage acts over the entire surface of the flat plate wing and the nose separation drag is considerable. Left when the wing is at an angle of attack. As this configuration was intended to

Turn to illustrate only the optimum fuselage for best pressure distribution the other drawings in the picture are not artist's conceptions of how the idea might be modified to meet the leading structural and stability requirements for hypersonic speeds.

It is not likely that anything except blunt shapes will be built in series but the principle is certain to be used to some of the more conventional Mach 3 aircraft now being built.

On these the fuselage might have a large, blunt nose and the wing which provides a free field covering most of the lower surface. The world record lift by taking the pressure under the wing a smaller hump might be placed on the fuselage above the wing to make a positive pressure over the wing trailing edge.

The positive field would be enough to exceed the negative pressure which is normal on the upper trailing surface of a structural separation wing chord shape.

Asymmetrical Contouring

Tim tells that type of leading edge wing and structural contouring will be built, that it is superior to the normal one rule for lifting configurations. The one rule is designed to reduce the drag due to thickness and is sensitive in the rounded plan. Some one rule designs are quite definite, in that it

ensures that the contouring should be symmetrical. The sharp surface the discontinuity is not fundamental and would arise because the starting assumptions are different or desirable configurations are being discussed.

The work that Tim and others have done with pressure drag reduction is also extremely concerned with reducing the drag due to lift. Better lift devices free and lower velocity drag also can be achieved through these leading-edge contouring fields.

Properly placed pressure fields can have the same effect on wing flow as controlling leading and trailing plan form shapes.

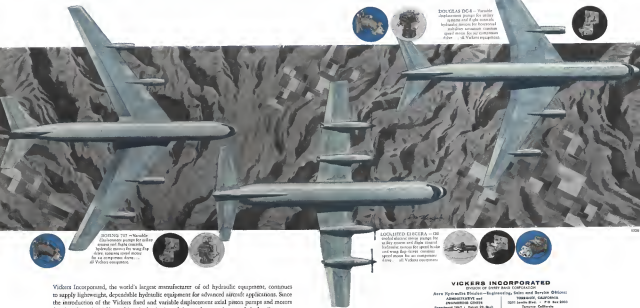
The raised method of reducing wave drag at supersonic speeds intercepting flow fields with surfaces, surfaces will probably be the most difficult to use in practice. But it theoretically offers total drag reductions of greater than 30% even for efficient configurations.

The impinging bipolar process proposed by Busemann illustrates the principle involved in all of this work. The best shock wave off such a structural surface is reflected back to the trailing edge. The flow field created by the selected forward portion of such surface is intercepted by the rear portion of the upper surface.

As the intercepting surface is shifted at the same angle, to the trailing edge surface the flow is stopped and an

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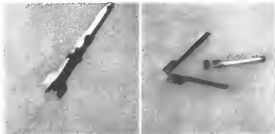
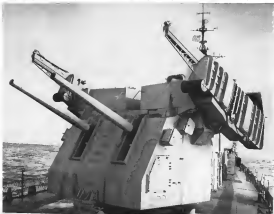
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Rocket-boosted weapon is launched from destroyer after attaching to control system for ejection data from ship's own guns.

Destroyer Fires Rocket-Boost Torpedo

Destroyer Tico, gun mount is launch platform for RBT (rocket-boosted torpedo). Weapon can be used on most U.S. destroyers.



Long range causes steep RBT to angle (left), shows advance separating from the torpede (right). Shortward flame is found when drops or blows off at proper place in flight by post-boost firing. Missile's range is several miles.

Problems—Rocket engine drives a light weight, aerodynamic, torpedo. Developed by Naval Ordnance Test Station at China Lake, Calif., and now in operational status with fleet units. Designated RBT (rocket-boosted torpede-boosted weapon), device allows surface vessel to wage submarine warfare from a distance without leaving torpedo station. Navy says RBT can be installed on any surface ship having standard 5 in. anti-aircraft gun mounts, but emphasis is on destroyers (see AW Feb. 17, p. 31). After launch, RBT has its target area when its fuse is triggered from torpede. Weapon then is lowered to water by parachute lower on target. Rocket engine now self-propelled fuel by control system and under computer which program variable flight, striking ships under attack.

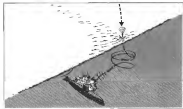


Diagram shows RBT setting into water after deceleration by parachute, then setting on submarine (above). Diagram below shows submarine runs torpede.



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SPACE vehicle instruments (top) control lifelines, lubrication, air concentrations. At right, subject performs radio control tracking maneuvers.



Farrell Ordeal Valuable Space Test

San Antonio—Vehicular Aviator Donald G. Farrell, in a space flight experiment at the Air Force School of Aviation Medicine, spent seven days in a completely sealed test chamber being used as environmental simulator at a simulated altitude of 18,000 ft. Temperature was kept at about 75 deg., and humidity averaged 60%.

Farrell emerged from the experiment in apparent good health and good spirits. Although signs of fatigue appeared in his handling of problems 72 hours after flight and finally, there was no psychological breakdown. No actual feelings will be reported until the Army Medical Area starting Mar. 24-25 at Washington, D. C.

Although the experimental space environment was sealed and self contained during the week long test, the early water recirculation system is not ready. It will circulate hot fresh water in the cabin, and liquid and solid wastes were stored in sealed containers.

Farrell had a stock supply of food with him. There was no fresh vegetable food as the fresh food could be used. Food was of a type generally available in one and other countries. He was not on emergency type rations.

As in the cabin was dehydrated, and oxygen was added as needed. Carbon dioxide was exhausted by a low density absorbent.

Farrell lived and worked in a 23 ft. air lock which broken down into two 14 ft. coves. This cove included two four hour work periods, a low level period for sleep, an hour and a half for relaxation and a half hour hygiene, or a one and a half hour period.

In the work periods, Farrell solved

problems in a manner which was equipped with lights and switches. Cabin was also equipped with a portable TV screen on which other problems were fed to him.

Generally, Farrell was confined to a fairly pleasant environment of moderate temperature humidity environment. The experiment was aimed at finding his personal reaction to conditions in these conditions under the work cycle imposed. Since 21 people react differently findings will be qualified by the test but then, perhaps specifically with Farrell.

The Farrell experiment provided a valuable test for the space cabin equipment. Further tests of similar duration and often for shorter periods are planned although a definite schedule hasn't been established. Testing with this equipment will continue even after manned space flight has been accomplished.

The Farrell test will also provide valuable material for planning of the first work-ahead tests for space tests.

Space Programs Pace Navy Weapon Trends

Washington—Space Navy weapon trends will include space propulsion, positive use of the weapon system concept and control combination using "autonomous" and "remote" human factors. Rear Admiral P. S. Wilmington, outgoing chief of the Bureau of Ordnance and chief of the Navy's space program, said today.

Adm. Wilmington also suggested five ways to attack "on operation" which give the sea-higher performance

capable system complexity plus greater cost plus more, more maintenance problems. They are:

- Improvements and sound thinking in the initial engineering concept
- More realistic projections
- Cost-conscious engineering
- Value engineering—The use of alternatives of standard vessel items
- Reduction in the number of structural hardware developments, and missile growth programs

Adm. Wilmington will be replaced by Rear Adm. Fred D. Shroy as chief with the Tarzon Patrol Force. Adm. Shroy was deputy and assistant chief of the Bureau of Ordnance from late 1954 until early 1957. He also is a former commander of the Naval Ordnance Test Station, China Lake, Calif., and former senior Navy member of the Weapons Systems Evaluation Group.

Adm. Wilmington, speaking at an American Ordnance Association meeting here, gave a summary of "sea-to-air" operations in Navy weapon trends, including:

- Trend toward weapon system development in the future, and there will be faster developments
- Integration and coordination of development effort in cases where there are three or more systems involved, will continue to improve, under the newly established "lead element" system
- Bureau of Ordnance will continue to decentralize the direction of development projects to its laboratories

• "Within the framework of a national program the Navy will play an important role in developable and related developments."

Adm. Wilmington also added his voice to the widespread criticism that "there are too many" but low water content and reviewing activities.

Fenwal Constantan Fire and Over-Heat Detectors are sensitive — at a given temperature there is a rapid decline in the resistance of the element and a signal is given. There's no heat averaging — at 180 inches a crew member or pilot can touch the alarm in one — or even two, days. That's remote pressure sensing!

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Fenwal

CONTROLS TEMPERATURE...PRECISELY

French Full Pressure Suit Has Capability for Use in Space

Press-full pressure suit made developed by French air space specialists will be available for space applications to U. S. troops.

Research and development at Toulouse, French air force flight test center south of Paris, clearly follows USAF leads.

Recent tests indicate that the French full pressure suit prototype which are capable of protecting man in space flight.

However, lack of funds and skilled personnel are holding back progress here. Full pressure suit is completed here is not expected before middle of 1959 or early 1960, according to Dr. Jean Coffin, French air force director of physiological studies, flight suits.

One prototype full pressure suit resembles USAF's new lightweight full pressure suit (AW Dec. 8, p. 29). Big size difficulty is with helmet design. "It is a series of compromises. On the U. S. suit, pilot cannot don crew plate until he himself and most eyes are properly protected. Pilot can possibly undress alone. Complete donning takes over about 25-30 min.

Helmet is attached by one of one ball-bearing nose and ear dipping around neck area. Helmet fit-down is achieved with nylon straps at each side of dipping and attached to shoulder of suit.

Two views are provided, one narrow type and other as flap-plank, and they close in opened and closed by pilot and is normally closed most of the time. Both face and rear view are semi-circular on large points of the ear points. Rear view uses a latex rubber gasket and opens upward over pilot's head.

Field of vision extends past limits of side vision and equals 150 deg. Two plates may also be equipped with line wire heating elements to eliminate fogging.

Acoustic valves are not as good as French would like, but provision is expected to be made of some. Microphone is integral part of helmet as well as ear phones, with the former placed in front and latter that pilot's lips.

Extreme of helmet is level-headed plastic and synthetic canvas padding for extra protection. French tried full head type helmet a few years ago, but rejected a plastic due to lack of crash protection.

Forward helmet weight is considered much too heavy, approximately 74 lb., with no immediate hopes of alleviation.

Weight for communication and logging channels ends in left side of the

Oxygen supply is located at rear of pilot's head. Helmet tube is hinged at left ear indicating attempts of suit to bend oxygen flow within the helmet. Helmet ventilation appears to allow private head ventilation compared to USAF's large published stream of full pressure suit.

Head shell is composed of three layers outside: an outer cotton, middle layer a reinforced airtight fabric and synthetic up to neck, side, and third layer on the inside. It is also attached with that of the second but contains holes about one inch apart over entire surface for ventilation purposes. Unique feature is not a combination of insulation to man with ordinary boots worn as foot covering.

Electric heating is integrated in ventilation layer. Leather gloves hand with silk and rubberized neoprene-like layer are worn over the scaled joints of the suit.



FRENCH AIR FORCE high altitude guard personnel in an operational status. Man now stands possibly a 10,000 ft. Suited in American 14 degree model shows capabilities on top and some of major back up to face view. Zippers secure shoulder and down inside coils of leg prevent allowing suit to maintain of base. Tramping at chest has covered base sometimes leading to chest bladders. Air G pressure monitor for stomach and leg is hidden on dorsal pilot's left side while signaling base while jet helmet plastic close to his oxygen supply. Back instead usually supports a plastic panel to late air pressure. Boots are standard flight equipment while gloves shown have been designed to include pressure bladders over lack of hand entering to finger tips. Long underwire is worn under nylon-stretch and end extends to wrist, neck and ankles.

Full pressure suit studies have been designed to fit most French high altitude aircraft operations suits. In one water helmet, suit would float pilot after separation from chair. Emergency oxygen supply after had out has been provided but studies are incomplete. To full weight of helmet and suit is as much as 100 lb. and would probably be around 15 lb. without head and other equipment.

Vision combination are being tested with a new helmet obtaining a pressure "stroke" in the suit allowing pilot good function of instrument and relative comfort. As yet no French full pressure suit has reached operational stage.

Defense Management Shortcomings Cited

Delos-Delaware chief should be first named under new efficient management principles and the power of Defense Department committees to handle military programs should be curtailed. Rep. Gus K. E. Gable, USMC, critic of the Delos-Army-Corps Council today.

Speaking at a hearing of Delos-Delaware on military programs, Gable also criticized the use of committees in military as "wrecking ball" for shortcoming to the U. S. defense (file).

Gable is manager of engineering program for Texas Aircraft Corp. and was formerly head of the Navy Bureau of Aeronautics' General Aircraft Division.

Gable made three recommendations from his report for improving the defense program:

- Reduce congressional and senatorial power regarding legislation, rather than leaving them attempt to become experts on military strategy or scientific development.
- Reduce drastically the size of the Department of Defense as its branches will grow trying to be successful and military straight and will stick to their management functions.
- Reduce budgeting and empowering experts to do business rather than providing them to act as an advisory agency.

Gable criticized the "bureaucratic committees, bureaus and reduction of government which have to be cut until substantially that each step must be taken and which, if they do not have the authority to approve a program, a project, are usually in a position to procrastinate, delay and hinder."

Committee on budgeting a five or 10 year program on a one year basis, then cutting the funds as many as three times before they are spent, was termed ridiculous. "If it were not ridiculous we might live with it, but preference



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it is lowering the cost of operation a whole order of magnitude," Galar said. "The Texas official pointed out the story in a Navy award to a top scientist at Naval Ordnance Test Station for development of the Sikorski's infrared guided missile.

Galar said the missile was developed in spite of repeated failure to secure funding from the technical-studies group in the Department of Defense and "because of the budget." He said the job was done with "black market" research and development funds pulled from other programs.

Galar also observed that many congressional and Defense Department big boys now calling for increased military efforts were cutting the budget, reducing the strength of the armed services and lowering long-range space programs a year ago.

Dallas group was advised to examine the record of outposts leaders who are calling for a stop to "militaristic capabilities that have held up the peace program." Galar said nuclear capabilities is being used as a shipping line and should be thorough attention. He said something is very strange when two people, one from Iran and Iran are considered a good example of looking to some performance and Japan and Thai are called horrible du phrases.

Someone has been lost or not called," Galar said.



LIQUID fluorine is transferred under pressure of helium gas in the tank truck.

Tank Truck Hauls Liquid Fluorine In 5,000-lb. Units Cross-Country

First tank truck designed to carry concentrated deposits of liquid fluorine cross-country is now in operation.

Owned by the General Chemical Division of Allied Chemical & Dye Corp., the truck has been carrying 1,000-lb. units of liquid fluorine on a specially scheduled line from General's plant in Baton Rouge, La., to "one man's love New York to Cold." Of these possesses Bell Aircraft Corp. in Buffalo and Kodak's Division of North American Aviation Inc. in Grand Prairie, Tex. Perhaps, the two most important.

Both companies are not firing post-type rocket engines which use liquid fluorine as the oxidant.

The fluorine shipping unit, built by Air Products Inc., is actually three tanks, one made of other. The innermost tank, made of Inconel, carries the liquid fluorine. It is surrounded by a stainless steel tank filled with the liquid nitrogen refrigerant. The third and outermost envelope is constructed of a mild steel, carries a gas-actuated relief valve material and a safety vacuum. The fluorine is transferred under pressure of helium gas.

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Interceptor Cockpit Test Model

Finalist configurations for future cockpit for a 2-engine interceptor aircraft will be tested by Gen. Inc., at several airports in Dayton, Ohio. Configuration was developed under Gen's contract with WADC, a not necessarily a configuration per se, rather both number of slots. Notably change a light control stick to the right, which feeds electronic and construction to give you control and replace radio panel. Engine gauges use one of many examples to give engine instrument data as well as actual condition information, with provisions for direct readings as one of computer failures. Control part of display is obvious of WADC phase II goal with substitution of all electronic function for attitude system, making aircraft readable on some instrument in pitch and roll. This display will be first generation of USAF weapon system, representing the phase II goal which is a suspended test production F-105 and F-106 aircraft.

PRODUCTION BRIEFING

Standard Machine Tool Co., Denver, Colo., has purchased the American Machine and Foundry Co.'s Turbo Division at Portland, Calif. Turbo, a leading producer of turbine power units for aircraft, will now operate at the Standard Turbine Division of the Standard Machine Tool Co.

Atlantic Research Corp., Alexandria, Va., reports installation of high temperature (18,000°) spin coating equipment for coating with ceramic and metallic films. Coating thickness from 505 to 875 μ can be applied with the equipment.

Correction

Noting that design stress levels in the case used on de Havilland Aircraft Co. Canada to help transport baggage have been so reduced that the structure should remain free from fatigue cracks over a period far longer than assumed by Airframe Work reported, should a crack be repeated by service damage, it could be expected to extend down—at 20 mph. from 16 in. per flight cycle (AW Sec 11, p. 96) to 14 in. Lead reports this statement should have said — should a crack be repeated by service damage, it could be expected to spread slowly. Crack propagation tests show that when a crack of 16 in. to 2 in. is introduced by service damage, 2,000 pressure cycles—the equivalent of 2,000 flight hours—could be applied before it spread at a rate of 0.1 in. per lead cycle.



PUMP PRIMERS
by Arthur A. Nichols
Generator pumps in a power source for hydraulic servo systems

Some interesting new applications for generator pumps have been developed to insure better operation of special and problems in hydraulic servo systems.

One of these problems took on early service where a new type of a six-rod fit was developed for a large ship. This situation is a persistent effect and the percentage in response to the condition of the sea has to be prompt, steady, and positive.

To do this job, the marine engineer developed a hydraulic servo system and a generator pump was selected to work with the engine elements to provide the necessary power for the main steering. Other applications of a similar nature have been made in the steering systems of battleships and other heavy vessels and the performance of hydraulic systems in other types of aircraft. Our experience in servo work of this type is shown for the editor.

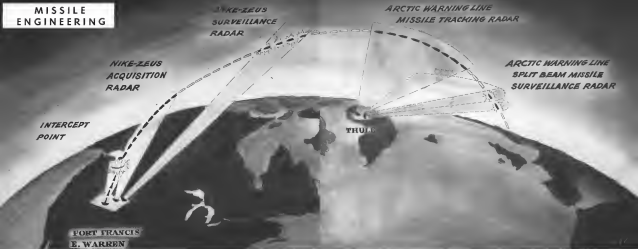
Important advantages are offered by the generator pump for special and applications. It is a positive displacement pump and provides a smooth power flow rate and of the pumping cycle to the other. Unlike other types of pumps which tend to slip work at the low end of the speed range, generator stay right on the job and provide positive power in the extremely low range. Thus, they are economical response in an actuator system.

The generator pump is a type of internal gear pump—simple and compact in basic design, this pump (one bearing parts). It is lightweight, accurate, provides exceptional performance and has low wear rate in long service life. In addition it is balanced and extremely quiet in operation.

Common applications for generator pumps are in the control of engine air in 1800 rpm. They are available for low pressure hydraulic and servo systems, hydraulic systems, jacks, servos and linear servos, electronic control pumping in aircraft and guided missiles, and other installations.

Technical information plus complete literature concerning generator pumps, engineering facilities are available to help you obtain the right pump to meet your performance requirements. Write for literature, complete information, service information and system performance literature is available.

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SOVIET ICBM aimed to strike USA's first ICBM tracking site at E. Warren, Wyoming, would be detected and tracked by...

USAF, Army Wage Battle for Control of

By James A. Fieser

Cooperation between Army and Air Force over which service it is to develop and operate U.S. missile defense systems is growing steadily more tenuous. Army is fighting for operational responsibility for the Nike-Zeus anti-missile missile system, a job it has been assigned to develop. USAF claims Nike-Zeus is a technological and inadequate in comparison with USAF's competing Wizard system.

Plans and control of both systems are being discussed more and more freely at both services' staff support team Administration leaders and on Capitol Hill.

Rusk continues to increase despite doubts last month by Defense Secretary Neil H. McElroy, dealing coopera-

tions, requiring Air Force to install a missile detection radar network in the Far North and Army to develop its Nike-Zeus system for installations here in the U.S.

Radar Sites

Missile detection radar sites existing up the Arctic Warning Line and the Nike-Zeus program have been placed under the Defense Department's Advanced Research Projects Agency and its newly appointed director Ray W. Johnson.

Following picture of the United States' planned missile defense program is emerging.

•Arctic Warning Line: Three long range missile detection radar stations will be established in the Arctic, one in Fairbanks, Alaska, another in Thule,

Crowland, and a third in another ice-free terrain. These radars will be capable of tracking all of Russia. They are expected to be operational in 1960.

•Nike-Zeus: Apparently chosen to sense it was further along than Wizard (since hardware exists for Nike-Zeus—some for Wizard) the Army insists on using three radars to detect, acquire and track an incoming missile, a fourth radar to track the sub-missile missile. Army says under present budget allocations Nike-Zeus will be operational in 1964 but believes that on a crash basis with more money it could be ready in 1962.

•Flute: A third sub-missile missile system called Flute has been under development for the Army. Flute is designed to be a search-missile system for defense of U.S. and allied field areas

Two radars of Arctic Warning Line, Surveillance, Acquisition and Tracking radars of Nike-Zeus system under proposed missile defense plans.

Missile Defense Systems

and control various installations against intruders' range before missiles.

Most authorities in the missile defense field are confident in stating that no such successful defense against an ICBM or IRBM is possible with any of the proposed systems. Anticipated "kill probability" of these systems will be only about 15%. Our objective, they say, should be to nullify the most effective systems now available with the close understanding that they are largely irreversible by achieving losses of traces in the field.

Arctic Warning Line

At each of the three long range missile detection radar stations that make up the Arctic Warning Line there will be two types of radar equipment. Both

types of radar will be capable of detecting incoming missiles at ranges up to 1,000 mi., but their functions will be different.

To detect Soviet-launched ICBMs at the earliest possible moment, each site will have a surveillance radar continuously exploring an assigned sector of the airspace high over Russia. These radars will cover an angle of about 45 deg. up but all three radars combined will provide continuous and overlapping coverage of the entire Russian land mass (AW Jan 27, p. 26).

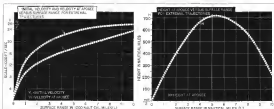
These surveillance radars set as good example of the AN/FPS-17 in design being used to track Soviet long range missiles from a USAF-operated base in Turkey (AW Oct 21, p. 26) and U.S. missile groups at White Sands, N. M., from a base in Laredo,

Tex. One important difference, however, is that the newest radars use an entirely different antenna pattern.

AN/FPS-17 features two a wide angle horizontally-oriented antenna pattern stepped vertically by a mechanical feed system. Because the horizon of the Far North surveillance radars will be to detect and provide angle information, data on incoming enemy missiles somewhere within their sector (to assist against a different tracking system).

Split beams vertically reflect by a few degrees, will be swept back, and both horizontally at a very rapid rate by means of a page origin antenna feed system. From the narrow angle of observation by a missile, angular displacement between beam illumination and time of travel, a computer will determine roughly the missile's trajectory.

The second type of radar at each Arctic Warning Line site will be ac-



PROBLEMS of intercepting long range missiles can be seen from charts showing extension and height of upper jet extended trajectories. While extension trajectories are most efficient, they are not necessarily optimum for missile performance.

le to the Lincoln Laboratory's Millstone Hill radar, located at Westford, about 30 mi north of Boston.

Purpose of the Millstone Hill type of radar will be to track the missile long enough to establish its identity as a search, a ballistic trajectory and not an cruise missile and, secondly, to obtain data for comparing past launch and point of impact.

The radar utilizes a parabolic antenna 54 ft in diameter mounted on a 50 ft tower. The reflector can be rotated through 160 deg and elevated from the horizontal to nearly 60 deg azimuth in about 2 deg. Second type of antenna feed is a horn antenna, which is both for use in search and track systems.

Tracked Sputniks

Specially designed 31 ft diameter parabolic antenna point outputs that have enabled the radar to track missiles fired at Ft. Churchill, Canada, Cape Canaveral, Fla. (both on 1,500 mi range), and Sputniks 1 and II (1st range to 2,500 nautical miles) with a relatively simple receiver. Equipment did not fail if S-3 satellite for first two weeks after launching because facility was that simple for installation of an improved receiver.

Output of the radar transmitter is 100,000 watts average power by one antenna equivalent, pulsed peak output is 10 megawatts, pulse length 400 microseconds, pulse repetition frequency 25 cps, and duty cycle 1%.

Because of their intense beamwidth, Nike-Zeus Hill type radars will depend upon the rough trajectory information furnished by the surveillance radar to acquire their targets. Tracking data will be utilized by a special translated computer developed by Lincoln Laboratory to compute target and

launch points which will be transmitted to Air Defense Command at Colorado Springs, Colo.

Radio City of America has been awarded the prime contract for installation of the three sites that make up the Active Warning Line. Contract was awarded to RCA primarily because of missile defense studies performed in partnership with General Division of General Dynamics Corp as USAF's World project. USAF will supervise the contract.

General Electric Subsystems

RCA will manage the contract and provide the high power generators for the radar system, plus some of the processing equipment. General Electric, the company that developed the AN-PPS-17, will build sub-systems for the surveillance radar, including the receiver and the antenna.

General Electric will build the radar antenna pedestal, radome, radar antenna feed and control hardware. Microwave detector products has received a contract for supplying most of the data processing equipment for the sites.

Total cost of this equipment and its installation is reported to be about \$720 million. A separate contract has been awarded to Western Electric to provide the forward radar communication links, located to the White Alert System. This contract is said to total about \$300 million.

Extensive Washington officials have expressed concern over the ability of the Active Warning Line to effectively provide 15 min warning of an ICBM attack. They doubt that anyone in authority in the government would be prepared to accept the responsibility for believing and acting upon such a warning without further confirmation.

In addition to the radar installation at Millstone Hill, which is the pri-

mary purpose of studying problems to missile defense, there will be ten other radars of the same type installed for related experimental and research work.

One Millstone Hill type radar is being shipped to Canada where it will be installed and operated at Prince Albert, in Northern Saskatchewan, as assistant of the Vanaville of Saskatchewan with the assistance of Lincoln Laboratory personnel. Canada Defense Research Board will handle the cost of operation.

One purpose of this installation will be to test radars and the radar beamwidth for high power radar as part of the program of the International Geophysical Year.

As is true of satellites and other spacecraft in the upper atmosphere, results of these studies may provide important information on the problems of satellite detection and tracking in the polar latitudes.

To combat the radar will probably be integrated into the Active Warning Line as backup against saturation of the communication and data processing equipment probably will be installed by late next year.

Third Millstone Hill type radar is on standby to track missiles fired from Cape Canaveral. This high governmental facilities especially are open to possible being used to help solve missile defense problems.

Other Warning Techniques

In addition to the warning of an ICBM attack that could be provided by the Active Warning Line, at least two U.S. companies are studying methods for detecting the launching of missiles from sites in this country. They are David Engineering Inc. and Wilson Electric Products.

Stead will be studying its proposed technique under direction of the Office

of the Assistant Secretary of Defense for Research and Engineering. This range is considered sufficiently precise to not require any response by the interceptors nor supply information in support of direction of the Assistant Secretary's Office, as an effort to keep the secret under wraps.

Active Defense

Studies of missile defense systems began with the start of the Gemini V-1 offensive against the port cities of London, Antwerp and Colon. These early approaches to the public—strong term General Electric's Project Thunder (MX-775)—concluded that defense against even an elementary weapons at the V-2 was technically feasible.

As far as missile defense is concerned, and larger range missiles such as the ICBM and TBAM has become a major threat, the problem of defense has, accordingly, become more acute.

The V-2 had a time of flight of about five minutes at altitude of 50,000 ft (highest point) of about 60 mi, and a range capability of from 75 to about 100 mi. For an active missile range capability of 1,000 mi, flight of intercept (as an extended cue trajectory) would be about 700 mi and time of flight about 55 min.

Improvements in missile range, therefore, have provided a more difficult increase in the potential tracking time, of the defense system for it to detect, identify, acquire, track and intercept the missile.

A second advantage for the defense is that success in missile range provide a corresponding decrease in the sector of origin of the threat. For example, ICBM launched from the most easterly and west westerly possible launching area in the U.S. is at a height in the U.S. would create a error, approach corridor only about 30 deg wide. A surveillance radar located at the target capable of all possible coverage for coverage might be adequate for ICBM detection. It would provide no protection against sub-launched ICBMs.

Nike-Zeus

Present plan of the Defense Department will install Nike-Zeus defense system to protect missile and bomber attack bases of the Strategic Air Command to prevent SAC's potential as a deterrent force.

System covers three types of radar:

- Surveillance: Upon warning of attack, surveillance radar continuously scans expected direction of attack out to range of 1,000 mi. Antenna is large 2.5 m diameter with rotating mechanism.
- Acquisition: As surveillance radar detects height it assigns data to acquisition radar which lock onto and track.

long enough to obtain accurate trajectory data. Acquisition radar has range of 600 mi, also use large Lincoln-Bell antenna but with electronic tracking.

• Tracking: Type 300 air tracking radar similar to the missile launcher by Nike-Zeus are employed with each Nike-Zeus battery.

One set of assignment from an all systems radar, will track the incoming target while the other set tracks the Nike-Zeus missile fired to intercept it. Both radar launch continuous position data to a computer which has a limited ability to guide the Nike-Zeus missile to the intercept point by radio command.

Naturally a complete Nike-Zeus installation will comprise an surveillance radar, two acquisition radars, each with four batteries of Nike-Zeus missiles with their associated tracking radar. For point defense problems, such as missile launching sites, the number of batteries will be varied to meet the requirements of the target.

For example, on the high sea where the most vulnerable target is the country to be attacked first will be an all island just past west of Christmas, Wyoming, and Ft. Stanton, E. Warfare, where the Air Force is building its first ICBM launching area.

These sites will be dispersed in distances from 10 to 20 mi around the central living sites, repair and supply depots. Here, probably one battery would be assigned to each site.

Coherent Defenses

Recovery of the surveillance and acquisition radars use a type of coherent detection developed by Bell Telephone

and Bell Telephone Laboratories—called Clapp.

Clapp technique utilizes coherent reception by use of a filter in the receiver which provides a linear phase-shift versus frequency characteristic, the slope of which is equal to the length of the transmitted pulse. Theory is that all cycles of the carrier signal will also be those at the output of the network. This is the manner the 500 microsecond pulse of the Clapp transmitter adds together as an output of about 1 microsecond.

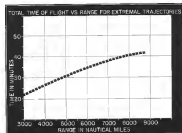
According to some of the authorities in the field, the Clapp technique is not out of the research and development phase as yet. Additionally, strong claims have been made that the technique is transparent and basically capable of discriminating between clutter and warheads.

Bell Telephone Laboratories, as the other hand, is reported to discount the necessity for active discrimination. Clapp officials have been quoted by military sources as saying that variations there are few but that Bell would not work on things that were practical.

Contractors for Nike-Zeus are Westinghouse Electric, Bell Laboratories, Drug In Aircraft and Casual Control Radio Co.

USAF's View

Air Force has not renounced hopes of developing its Warning system, at least in conjunction with Nike-Zeus if not in place of it. Defense Secretary McNamara's memorandum to USAF last month, however, and USAF now to discontinue research and development on the missile radar—although some work is still being done under development. USAF officials say that the proposed



TOTAL time of flight for long range missiles on extended trajectories.



Ready... AIM...

New P-E missile theodolites automatically align inertial guidance systems to within a few seconds of arc.

A new family of missile auto-theodolites has been developed by Perkin-Elmer to align inertial guidance systems with unprecedented accuracy. These theodolites are now operational at a number of missile sites and are being used in the production, testing and alignment of stable platforms.

P-E auto-theodolites monitor and automatically correct guidance equipment to within milliseconds of arc under day or night luminous conditions. They are available in short, medium and long-range instruments which operate from distances up to 1,800

feet. Although these auto-theodolites were developed for missile work, they are easily adaptable to a variety of non-military applications requiring highly accurate angular data.

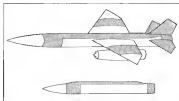
These instruments are examples of Perkin-Elmer's ability to combine precision optics with electronic and mechanical systems. For regular information on Perkin-Elmer's design, engineering and production facilities, ask to receive circular 2112, our new quarterly publication. Write us at 133 Main Avenue, Norwalk, Conn.



Perkin-Elmer Auto-Aligner. Alignment auto-theodolites. Auto-Aligner—medium distance, 4-11/2 feet, beam—medium range, 1-1/2 to 10 feet, beam—long distance, 2 1/2 to 10 feet, beam—short range, 1-1/2 to 10 feet, beam—short range and adjustable distance for alignment.

ENGINEERING AND OPTICAL DIVISION

Perkin-Elmer Corporation
NORWALK, CONNECTICUT



Bomarc Alloys Resist Heat

Fast lap rate use of heat resistant magnesium alloys is incorporated in USAF's BOMARC missile built by Boeing Airplane Co. Magnesium alloys that are strong, lightweight, and stiff are also chosen for magnesium thermal coatings. These alloys are used for coated surface lining and trailing edges.

Winged section is tightly interconnected with a long range self fuel nozzle and an effective main-propulse motor with a two high degree of discrimination between warheads and drogue. They say the section has never gone beyond the planning stage simply for lack of money.

Features of the Wined section are:

- Phase I program is for the development of a single stage ramjet with a range of 1,000 mi., and the capability of intercepting all subsonic vehicles.
- Phase II program contemplates addition of a second stage, to the ramjet to provide maneuvering capabilities of altitude of 300 to 500 mi.

USAF's present contention on the Wined project have been Radio Corp. of America and General Dynamics of Concord, Mass. Radio Corp. Subcontractors have included General Electric on static warheads, Sanders Associates on terrain system, D. S. Kennedy on logic problem, and Avco on electronic timing device.

Plate System

Designed to protect field crews and optical installations on even, the Avco's Plate anti-atomic missile system is now the hardware stage where postlogic parts take end-stage test.

A possible future application of Plate that is among such variety is the prospect of protecting the system in NATO sites as part of the independent to accept IRBMs from the United States. One of the Soviet strategic thrusts is Europe in the nuclear-tipped IRBM.

System is presently being considered for production of U. S. office faces sub-sonic-launched IRBM's.

Plate is a reliable stable reference consisting of van for the electronic equipment, electric reference and spe-

cially designed mobile benches for the Nike Zeus missile. Plate is a common problem system whereby a computer is fed continuous position data on both the incoming target and the Nike Zeus missile. Computer then guides the missile to the intercept point and discriminates its warhead by radio signal.

Plate contractor for Plate is Bell Western Electric, Portland, Maine.

Photo by Gordon S. Anderson, General Electric and American Machine and Foundry.

Unsolved Problems

New problems appear to be solved before missile defense systems will be able to attain acceptable high kill probabilities. At the present time little is known about the best method of detecting an attacking warhead. Scramble tests using Kirtland AFB will be conducting tests on the effects of an clear blast in the upper atmosphere the spring of 1962.

Then, techniques that seem to offer possibilities are:

- Particle interception. High kinetic energy of an approaching IRBM warhead can be turned to good effect by exploding a cloud of suitable particles in its path. Largest errors may be again corrected by after the warhead characteristics of the pulse occur and cause it to scatter itself.
- Neutral solution. In the upper atmosphere, where the return surface solution from an atomic explosion is not absorbed by an ionizable material in the casing warhead may be exploded or ionized to a nonionizable netup.
- Thermal solution. Because return errors for nose cone accuracy are very stringent, it may be possible to detect

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Experienced in the field of aero-thermodynamics and heat transfer and capable of directing the activities of other engineers in research and development work in aerodynamic heating at hypersonic speeds and in applications of theory to structure and equipment heating.

Should be capable of formulating wind tunnel and other laboratory test programs concerned with aerodynamics heating and heat transfer. Should have a good theoretical background in aerodynamics and thermodynamics with some special emphasis on boundary layer theory and real gas effects. M.S. or Ph.D. degree preferred.

OPERATIONS ANALYSTS

Opportunities in operations analysis covering the whole spectrum of Weapons Systems, M.S. or Ph.D. in Engineering, Math. or Physics preferred. BS with exceptional experience will also be considered.

For more information please write to Mr. A. R. Stevenson, Engineering Personnel, North American Aviation, Inc., Los Angeles 45, California.

NORTH AMERICAN AVIATION, INC.

THE ARMY H-23D . . . HELICOPTER WITH TOMORROW BUILT IN



Design of the basic H-23 helicopter was largely governed by a doctrine of ruggedness. It has produced a dependable helicopter, with a record of safety unequalled in its class.

Now, in the H-23D, a completely new 1000-hour drive system is introduced, seen as a major break-through in lower operating costs. A full-time 250 horsepower is available and, significantly, without "redline" restrictions warning of jeopardized service life. Thus, ruggedness has also afforded growth potential.

In the H-23D, growth potential assumes a new importance. Its existing components are designed to accept even greater power increases for the future's most challenging performance demands. Now, more than ever, the Army H-23 is an investment in tomorrow.



MILLER HELICOPTERS

PALO ALTO, CALIFORNIA

a warhead by using its temperature with a carbon fiber probe to its receiver. A consideration of many nuclear launch or retrievable warheads of this type is that the U. S. is not now producing enough fissionable material to meet this requirement in addition to its present commitments.

Clouds of Decey

By the time that any part of the U. S. missile defense system is operational a new generation of problems will have arisen. Simplest technique for confusion or deception, including radar and gaspulses, is by surrounding or obscuring ICBM warheads with clouds of decoys if the cable cannot tell the difference between them. It will not be unrealistic to estimate thousands of potential biological launch filigree along the way.

Both the country and Russia now work an exploring decoy technique. The Minerva Co. is studying decoys as protection for its Atlas ICBM. Some scenarios are reported which is by letting a technique for generating hundreds of decoys by exploding the fuel stage of their ICBM.

The Soviet technique consists of separating the missile's lead stage, rocket from the nuclear warheads, before the apogee and blasting the rocket casing, fuel tanks and motor into fragments with a high explosive charge. Fragment will depend for safety on its ability of the warhead with mass of the fragments making better targets than the warhead itself.

All the current attacks, where the first stage used, would be frustrated. The very thin upper atmosphere would not slow the fragments appreciably. They would maintain about the same relative velocity as the warhead until almost its reentry into the lower atmosphere about 25 to 30 km from the target. Decey would be demonstrated over an area of several thousand square miles extending both in front and behind the warhead.

There are three techniques by which such decoys could be constructed:

- Detection at re-entry. At re-entry, the decoys will be slowed in the atmosphere because of their relatively smaller mass compared to the warhead. With this technique it is necessary to wait until the warhead, approaching at speeds close to 15,000 mph, is about ten seconds away from its destination before attempting to launch an anti-missile missile.
- Detection prior to landing. If the missile can be tracked by radar before fragmentation of the rocket, the target following the reentry. If the target may could be predicted to be the warhead. This method, however, appears to be unreliable.
- Detection by target analysis. Soviet

comparisons in this matter, an exploring technique known as "flow structure analysis" of radar echoes, flow structure analysis provides information on target velocity, acceleration, deceleration and other signal characteristics which can be used to determine by means of ground warheads. Much development work remains, however, before these techniques can be applied operationally.

Budget Problems

Question of how money should be spent for missile defense is still being debated. Administration and Air Force officials reportedly have accepted a R and D report recommending that the anti-missile system be concentrated at a fixed SAC. Bomber and missile bases.

Civil defense officials, however, are said to be pushing for an extensive shelter program, based on the fact that the Arctic Warning Line should give 15 minutes warning of a missile attack which would be enough time for most of the civil population in the target area to seek shelter.

Soviet Missile-Equipped Sub Fleet May Change U.S. Defense Tactics

Sea Dago—Threat of Soviet missile-carrying submarines does not demand that the United States counter with an equally large sub fleet, Adm. Almiral Burke, Chief of Naval Operations, said today.

Adm. Burke pointed out that the navy is reassessing its anti-sub strategies, but anti-submarine tactics and aircraft carrier submarines for anti-submarine warfare are effective but expensive.

He said that present anti-submarine resources are less so five times as effective as they used to be World War II. Burke said a 10 ton class U.S. Navy will have several hundred nuclear-powered ships. He said some of these may be smaller than the current Nautilus and Sea Wolf as advances in technical knowledge make smaller pens possible.

Submarine, says Burke, is a deterrent possibility, but Burke explained that currently it would cost 10 or 15 times as much to transport a given weight under the water as it would to carry the same weight above water.

He said the line effort in this direction would probably be broken, even if it not necessary, by crew legends which he pointed out. That would increase the engineering problem since the pressure hulls have the largest structural loads.

Missile Storage

Adm. Burke said that storage space for the Polaris fleet ballistic missile as future submarines are tailored so closely to the big world as to limit the size and

A third product, possibly under intensive study, is a program for modifying existing and planned Nike Hercules and Nike anti-aircraft missile launchers to carry anti-missile systems.

Navy has been studying possibilities of using Talos at a dispatch site missile launchers for some time.

A House Committee and an Air Force subcommittee, Dr. Melvin C. Hall, speaking before a recent meeting of the American Ordnance Assn., argued for concentrating all missile defense on the acquisition of SAC.

Emphasizing that he was expressing a personal opinion, he said, "It is unrealistic to rely on air strategic or power to use self-defensive force, and consequently rely on air defenses to counterstrike them primarily upon the limited but indispensable duration of protecting that force . . . we would not appear likely to return total war, but would intend study to provide month-long protection of our defenses."

There is every indication that this will be the U. S. missile defense program for the foreseeable future.

of conventional subs by spending the defense.

Adm. Burke said the Soviets have apparently cut their submarine building rate far below the 100 per month rate reported by the navy about a year ago. He said they are probably concentrating on the design and testing of a few nuclear subs primarily to replace their conventional boats.

Burke said a 10 ton class U.S. Navy will have several hundred nuclear-powered ships. He said some of these may be smaller than the current Nautilus and Sea Wolf as advances in technical knowledge make smaller pens possible.

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Missile Storage

Adm. Burke said that storage space for the Polaris fleet ballistic missile as future submarines are tailored so closely to the big world as to limit the size and

building the structure for modern flight



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stage of replacement studies. For instance, he said, it would be difficult to improve on a carry storage vehicle such as a ballistic glide rocket booster.

Bailey said that if a single vehicle agency is given the responsibility of increasing the development of space technology, National Advisory Committee for Aeronautics or some similar existing group should be studied before deciding to set up a new body. He noted that MACA has the advantage of its existing staff of scientists as well as working relationships with other scientific organizations. He said the Navy has no current manned space project.

Navy's Ft. Meigs missile range will be approximately as long as Air Force's Cape Canaveral range when completed for testing of Polaris, according to Adm. Burke.

Longer Range Indicated

This seems to indicate that longer range missiles are in the offing for Navy stock maximum range of Polaris is about 1,700 mi. and Caswell range is about 3,000 mi. long.

Site and shape of the range are actually not firm yet, Baile said. Approach and departure channels for air traffic between Los Angeles and Honolulu he right across the middle of the proposed range. Navy and Civil Aeronautics Administration are now trying to arrange a time-sharing plan to safeguard traffic without infringing too much on range objectives.

When questioned about Navy's programs in the anti-rocket field, Baile said that he believes Table to be the best existing weapon against ballistic missiles and that Navy programs for new ones are still in the research phase.



Unit Spots Defects In Missile Oxidizers

Caution detectors in outside oxidizer systems is now possible with a detector developed by the Allentown Manufacturing Division of the Garrett Corp. Cartridges or formations of bubbles occur when pressure at any point in a fluid flow system approaches the vapor pressure of that fluid. Occurrence

of this is usually oxidizer systems can result in explosions when the oxidizer fluid is in contact by the bubbles in the system.

The detector, based on a phenomenon in the cryogenic and hydrocarbon field, detects any tendency of oxidation and fluid system of oxidizer to create while undergoing development, in the test stand prior to flight, or in flight.

Another missile application is the detection of cavitation when booster rocket engines or fuel systems approach depletion and pressuring gas enters the oxidizer or fuel systems. Maximum fuel range with gainer missile stage

can be secured as well as maintaining a balanced quadrilateral area below booster nozzles are achieved.

Detector, consisting of a sensing mechanism and controller composed of electrical circuit, test instrument leads to an oscilloscope, a firing circuit such as a retard burner spark source, or a sounding transducer. Controls can be selected for individual fluids such as water, liquid oxygen or hydrocarbons via, depending upon liquid tests.

Patented industrial applications for the new detector include, doublet pumps in petroleum refining operations and normal and stationary boiler feed pumps.

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DATARITE magazine Type S-947 attaches directly to the versatile S-114 and Type S-606 attaches directly to the S-119 Recording Oscillograph without modification or adapters. Magazines hold 600 ft. of film-base

recording paper. Record and read numbers are automatically registered for ease of data reduction. For example DATARITE details contact your nearby CEC field office, or write for Bulletin CEC 1568-X3.

Description literature on CEC's Recording Oscillographs: Type S-114 (16 and 20-inch models, 7-inch record width); Bulletin CEC 1500-X17; Type S-119 (16 and 20-inch models, 12-inch record width); Bulletin CEC 1536-X30.

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Electrodynamics

300 No. Sierra Madre Villa, Pasadena, California



Ryan Vertiplane Taxis, Undergoes Engine Tests

Ryan Annotated Co. Vertiplane, Area VTDL recently started engine test (above) at Lindbergh Field, San Diego. Cold-ice engine tests, vehicle attained speeds between 30 and 40 mph. At right, single Leomaning T15 gas turbine engine in fuselage is set up for engine testing. Aircraft will undergo 40 hr. of engine tests before flight tests are conducted. Level lift vehicle was built under direction of the Office of Naval Research. In photo below, Vertiplane leaves during engine ramp. End plates on wings create lift; plates to flap open and close retractable wing flaps direct propeller slipstream forward into two.





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MAIL MAIL Aerial Delivery Service's rugged container drops, having pulled 31,000 lb. M-55 gas from C-119's cargo hold, drop and recovery parachutes. Forward portion of heavy load forces pilot to steer down position. Note T-28A observer plane.

Army Tests Automatic Vehicle Air Drop

By George L. Christian

Detroit—Automatic paratrooper-operated system of parachuting Army vehicles weighing up to 10 tons quickly and safely from cargo planes to battle-field areas will soon go into operational suitability testing. All engineering testing, conducted in three phases, has been successfully completed.

Called Dual Rail Aerial Delivery System, concept was developed to give the Army the greatest possible unexpended logistic capability, high ground mobility and maximum firepower as essential to conducting effective brush fire war tactics.

Major advance of the new system over preceding methods of air drop is its automatic operation. Entire drop sequence of one or more vehicles is initiated by the pilot pushing a button in the cockpit, no additional assistance or manpower is required. The parachute is based on pins in the plane's cargo hold, which had to be perforated to release loads using old drop systems, have been eliminated.

System was developed by Beards & Perkins, Inc., here. Company specializes in suspension fabricating techniques and is currently testing out

among many products, 28-in. diameter magnesium parachutes designed for Paracut V-type.

Esset of the system is three sizes of rugged, magnesium platforms which carry the paratrooper vehicles to Earth. Design life of the platforms is a maximum of 10 drops (expected one of platforms would occur only under pressure positive conditions). Actual tests show that platforms can exceed the 10-drop maximum, according to Brooks & Perkins officials.

To date, some 75-100 drops have been made to test the system and demonstrate its effectiveness. Beards & Perkins technicians say the tests pointed up important lessons for the three services. An F-4U dropped Army vehicles at Navy's 6511th Parachute Test Facility, El Centro, Calif.

While the vehicle was specially altered to Lockheed's C-119 Hercules, Brooks & Perkins engineers have conducted a compatibility check of the system with Douglas' C-119A and found it satisfactory.

Aerial delivery system is designed to give maximum assurance that the variety of vehicles scheduled to be parachuted by this means will survive the drop intact and be capable of operation

the moment they are released from their platforms. Currently 17 tanks, trucks and mobile artillery and road building equipment vehicles are scheduled for use with the system. All but two have actually been dropped.

To assure maximum vehicle safety after drop the system design includes:

- Rugged but light magnesium platforms which carry the vehicles during the drop and protect them on landing. Company says that magnesium's resistance to burning allows it to give more severe protection and also resists damage to allow the platforms to be reused many times instead of being jettisoned after a single drop.

- Essential restraint system—two strong steel pins—which positively lock platforms and its cargo to two rails on floor of cargo plane to preclude possibility of the cargo shifting during flight through turbulence or. System also supplies positive, automatic release when extraction chute starts pulling cargo out of the plane. An emergency manual release is provided in case automatic system is badly damaged.

- Drop is accomplished by pilot pushing button.

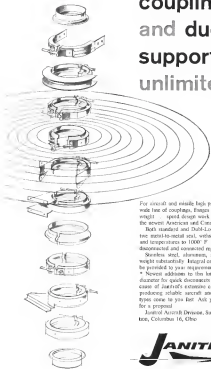
- Rather, unassailable distribution bags, several of which are used under



ARMY self-powered gas starts to swing on parachute slings. Last five feet of platform will extend around vehicle (top left). Gun falls in Junk under its 130 ft. dia. canopy which help to stop oscillation. Note distribution bags under platform (upper right). Automatic device cuts canopy loose on landing (below).



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For aircraft and missile high pressure ductwork, Janitrol's wide line of couplings, flanges and duct supports cut save weight - speed design work. They're already proved on the seven American and Canadian aircraft.

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* Newest addition to this line are couplings up to 36" diameter for quick disconnection of jet engine tail pipes. Because of Janitrol's extensive experience in designing and producing reliable aircraft and missile hardware, prototype come to you fast. Ask your Janitrol representative for a proposal.

Janitrol Aircraft Division, Surface Combustion Corporation, Columbus 16, Ohio

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each platform quickly loading against firm elastic supports to prevent vehicle frame sagging.

- **Positive, quick-acting release** to set loose, multiple platforms within the instant load lifts the ground and frames (no suspension wires should have struts released).

This permits wind-propelled escapees from non-bearing vehicles on the ground - and to rendering them motionless.

Some use the capability - although not usually - of dropping vehicles in the combat zone (both faced and odd) conditions.

This permits them to go into action instantly, according to Heide & Preiss claims.

Three Platform Sizes

Zone Droops & Triflex series is built around three basic different size platforms, all 8 ft 8 in. wide:

- **Small size** Length 11 ft., empty weight 800 lb., normal load, 1,500 lb., overload 1,800 lb.

- **Medium size** Length 15 ft., empty weight 1,200 lb.; normal load, 2,400 lb., overload, 3,000 lb.

- **Large size** Length 24 ft., empty weight 2,000 lb., normal load, 34,000 lb., overload, 38,000 lb.

Platforms are slid into C-130 on a job of task, about 15 ft. length allows several combinations of sizes for multiple drops (weight of sub is about 1,000 lb.).

Among possible platform combinations which can be carried in a C-130 are three small, two medium and one medium, two medium, one medium and one large.

Five Drop Complexities

Practically up to 10 tons of vehicles in single or multiple drops, from altitudes of 2,000 ft. to 3,000 ft. or lower with a high degree of successful delivery requires a system of a certain complexity.

Here are details of the Droops & Preiss series:

- **Cargo is linked** to a platform, then step-downs here and runs chute system - which may include up to an dozen coupling some 1,200 lb. - are attached.

- **Platforms** is pushed into airplane, or often mounted on dual mount unit load or quickly made fast to rails with two, steel restraint pins which slide into reinforced fittings, one in each rail.

- **Extraction chute** - using ring and cone pins 15 ft. or 22 ft. in diameter - hangs on a structural beam shackle in the upper rear portion of the airplane fuselage and connects to the lower of the platform immediately behind it so that each load follows the other in quick succession.

- **Cargo doors** are opened. Pilot pushes

a button in the cockpit to release extraction chute so wind the cargo can see a bomb-bay opens its bay door. After the release button is pushed, no time drop sequence, an activate.

- **Extraction chute**, released from the bomb shackle, swings downward and is raised through 90 deg. arc, which drives pinches it out of the plane.

- **Platform**, released from the bomb shackle, swings down and is raised through 90 deg. being attached to the plane's structure by a line. Motor pinches it out of the cockpit and drops cargo immediately.

Once control by extraction line on platform accomplishes these three things:

- **Pull restraint pins** through a mechanical linkage to release the platform. Job can be done manually if automatic mechanism fails.

- **Push platform** backward out of the airplane's hold.

- **Deploys main escapee**, as platform leaves the plane, an arm on the platform, which rides on the side of a rail, is released and swings out. The release fitting from the platform and extraction line is transferred through



FIRST successful drop of an M56 gun on a stressed emergency platform. Destructive load has been compressed under load. Auto-tapping does extend beyond platform.



SUMMARY of loads of vehicles and aerial loading equipment which can be dropped by aerial delivery system: 1. Tractor 1 ton 2M water tank (3,800 lb.); 2. Gun, M2 propelled, M56 (15,000 lb.); 3. Tanker 1 ton 2M water, M19 (6,250 lb.); 4. Gas tank (5,500 lb.); 5. M56 (15,000 lb.); 6. Gun, 97 mm, M143 (2,500 lb.); 7. Gun, 75 mm, 4 ton (5,500 lb.); 8. Gun, 81 mm, M29 (5,275 lb.); 9. Howitzer 105 mm (5,850 lb.); 10. Gun, 90 mm, M124 (13,100 lb.); 11. 1 ton truck (5,500 lb.); 12. 2 ton truck (11,000 lb.); 13. 2 1/2 ton truck (15,000 lb.); 14. 3 ton truck (19,500 lb.); 15. 3 1/2 ton truck (23,500 lb.); 16. Tractor 100 HP without trailer (16,700 lb.). All units have been dropped by aerial delivery system except two vehicles marked (*).

Flyers Agog at Spectacular New Terminal



Color and panoramic cabined continuously at front door. Blue lobby, VIP suites, flight ops room, restaurants, Flight Deck Restaurant, coffee shop on second floor.



Extensively-furnished main lobby features oak paneling, recessed floor, colorful view of ramp and runways. Adjacent flight ops, crew rest, and restaurant.

BIZ AVIATION'S TOP SHOWPLACE WINS APPROVAL

The top Southwest Airlines opened the doors to new business and military flying terminal because the sense of awe, bearded drama and happy human emotion.

A pretty well-known body would have any man on airport with her plastic-lined ducted along beside body inspecting the plain SAC lion. She examined up everyone's reaction when she took or let into a deep chair at the lobby and said, simply "Ahhhh-hhhhhhh"

An airline executive pilot was overwhelmed by the flight ops team and related stresses and just finally couldn't believe it all.

"It's great," he said "but where's the catch—what's it one me to see all this?"

He nearly split his leather face wide-open grinning when told, "Nothing—nothing at all, jockey."

When the manager of the second floor Flight Deck Restaurant first saw the night-time view out his great panoramic window, he set down almost reverently and said "Where have I been all my life? What a place to eat!"

The top VP of a firm making new business planes, described as appointment, special as best taking a all in, then exclaimed:

"We've arrived—and I don't mean just Southwest Airlines! All of us in business aviation here now arrived."

Now, we want to know what YOU will say. Come take a look—we've provided you'll say plenty.



Lobby and bar



The bar area



Flight ops room

a few dozen platforms to legs or stank nose chairs are packed.

Suspension lines and elastic runs are deployed, legs are stepped down the centerline and load becomes pneumatic. Heavy lateral motions are absorbed by variable stiffness in cargo blocks. Lateral descent lines runs with landing altitude but averages about 10 sec.

Diameter of main supports is either 64 ft or 100 ft, depending on the weight of the load being dropped.

Decelerator Bags

As the extraction fitting is released from the platform, a cartridge with 14 sec delay is actuated. When it trips a lever to open nested-lined plywood cart-topping lines as the bottom of the platform. There are four doors on the small platform, six on the other two sets.

Doors are angled toward to swing outward 150 deg so that in the open position, they extend somewhat beyond the sides of the platform. The protruding edges of the suspension structure from digging into the ground, helps the entire load to slide along the surface of the terrain and avoid overturning.

When doors open, they release collapsed inflatable, reinforced nylon decelerator bags (2 in deep and 35 in diameter).

Bags inflate with air through 12 in diameter openings at the bottom of each unit passing through emergency flapper valves which keep the air from escaping on landing impact.

Compression of bags as load settles to the ground blows out special balloons on the top of the bags, releasing or trapping air through relief depressures which act as variable orifices, this is designed from a normal spacing 4 in diameter to a diameter of 7 in under pressure. Puffs of the variable orifices it to get maximum work out of the bag by maintaining constant pressure within shock damping deflation. Bags are made by Goodyear Tire and Rubber Co.

Automatic Parachute Release

Another automatic system, which includes cartridge activation cuts the main suspension almost immediately after the load touches down.

Release occurs when retraction on load suspension motor reaches 75% of maximum.

Parachute release sequence is such that when the main shrouts are dropped off the cargo platform, a load is mounted from the plane. Fuses which pull charges out also fires a 30-sec delay cartridge. Delay prevents inadvertent separation of capsules from cargo during the act of parachute opening.

When the cartridge fires 30 sec after

load leaves the plane, it allows the ground decelerator fitting, located between chute runs and platform support, to release the supports through ring struts when tension on the fitting allows TSS. This prevents the shock from digging and overturning the cargo.

Advantages of Magnetism

Brooks & Perkins engineers told Aviation Week that they manufacture the platform out of magnesium for two reasons: its lightweight and its low coefficient of elasticity. This latter attribute gives platforms the ability to absorb deflection loads with less damage to the

structure than if it was made of such other metals as aluminum or steel. They noted three models of elastomeric gaskets: Magnesium-0.5 milia, aluminum-12 milia, steel-70 milia.

Advantageous design made during a test revealed construction would result in the relatively expensive platforms being used only once.

However, over the platform, an angled struts to be used once, however, during the maximum pressure, practice drops, they will be subjected to Brooks & Perkins efforts but feel the platform's overall cost will be compared to 50, or less than, other impact protection devices available.

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Whenever your aircraft and airfield planning calls for a rate gyro, specify R. C. Allen... proven in flight countless times over. Rate gyros are designed to your specific requirements and sent as a component for your evaluation. Volume production facilities are under strict air pressure and cleanliness conditions. R. C. Allen designed rate gyros meet conventional specifications of MIL-EGS-22A. Request no heater for damping from 2 to 500 lines critical, with temperature compensation from -55°C to +50°C. Small, efficient, hermetically sealed and sturdy. Write or call for complete information.

TURBINE FAN INVERTER STANDARDIZED FOR LOWER COST

Always specify standard R. C. Allen Turbine Fan Inverters, built under most rigid quality control according to government specifications MIL-3-765G, MIL-1-780A, MIL-1-781A, and MIL-2-585, and to CAA TSO-G6, AS96.



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This 4 to 6-place Commander is the first and only pressurized twin-engine transport built expressly for business. High speed, high-altitude comfort, all-weather air conditioning, optional lavatory compartment and handsome new interiors are but a few of the performance and comfort features of this new supercharged Commander.

SUPER 680

A favorite with men in a hurry, this supercharged business transport delivers the executive team to its destination ahead of all competition. The 7-place 680 Super is the fastest airplane in its class with a top speed of 260 mph and a cruise speed of 230 mph.

S60-E

A wider wing span plus powerful new Lycoming high-compression engines give the S60-E great range and load carrying capabilities. This 7-place model of the Commander is the most comfortable and luxurious airplane in its price class.



Illustrated brochures and new "Entered to Business" Lease-Finance Plan are available on request.



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STANDARD jeep is compared with folding model (left). Legs support weight until wheel lockup, shock strain is compressed (right)



REAR wheel air driven by compressed 600 cc. 10-hp cylinder motorcycle engine (left). Flat bottom becomes rough terrain (right)



Folding Jeep Built of Aircraft Materials

Lowest-floor passage, 700 lb. air borne folding jeep with a top speed of 60 mph which can be paralleled to almost any terrain is being built by Harlowe Aircraft, Inc., at Union Airport, England.

Use of aircraft materials and building techniques allowed the company to separate the vehicle when folded, into a package 9 ft long that occupies 13 cu ft.

It weighs less than 400 lbs. and the weight of an engine is less than one fourth the weight of a standard 4-ton truck as jeep, according to the manufacturer.

Jeep is powered by a 150 cc. BSA, four cylinder, air-cooled 35-40 hp motorcycle engine.

Suspension is independent all around and steering is by rack-and-pinion.

Jeep Details

Manufacturer lists these features: It is designed into the airborne jeep.

• Frame fits own container when folded and can be stored in an aircraft aircraft locker.

• Handling by four-way cross air springs when folded. They can unfold it and make it suitable in one minute.

• Flat bottom of chassis, when in operating condition, makes it easy to dig or ride over rough terrain by the new Operator ground clearance is 6 1/2 in. Engine drives two wheels through compressed chain. Differential is

changed for amount of torque and complete. A clutch is incorporated in the gear shaft lever.

Chassis structure consists of a deep narrow central beam made of light alloy. Diagonal struts on either side are dual sheet aluminum pressure which include two folded gear rack.

Front wheels which leave the container when folded, are air sprung and designed to make the vehicle mobile. They lock to the chassis bottom.

Front and rear shock are mounted to the chassis with shock absorbing struts to cushion the ride. Wheel suspension, steering and drive linkages can be partially disconnected and stored or as needed with minimum effort.

Photo-Boarding Paper

Photo-boarding paper that supplies data on in-flight variables up to 100 sec after contact, has been developed for use in conjunction with new special-type moving picture film available in quantities of three rollers ranging from 1 to 5,000 ft.

Kodak Longex-Dent Print Paper can be used in tests of high speed, normal jet aircraft, mounted in installations on the ground. In tests that the aircraft has been subjected to the paper roll conditions, this term, which can be directed properly and oriented previously, when in flight cases were made, the rollers were often not so damaged and loading.

The new material, which holds up pressure sharply and selectively, is made to give a high degree of positive curve in rolling in a roll to 50 ft with a 50' section of acid film supplied by the manufacturer, followed by a three-mile water wash.

Eastman Kodak Co., Republication Sales Division, Rochester 4, N. Y.



Chamber to Test Nuclear Aircraft Engines

Steel chamber will test nuclear-powered aircraft engines at the CANEX Project (Consent to Assist Nuclear Engine Laboratory at Melville, Conn. The 1500,000-pound vessel measures 98 ft long and 121 1/2 in. dia., weighs 160 tons and is designed to contain structural pressure of 150 psi. Chamber, constructed by Laker Steel Co., will be installed at CANEX site early this year.



Fuel Booster Pump

Submerged electric motor driven axial fuel booster pump is designed to pump fuel at 100 psi or higher positive pressure. It is built on stainless steel tank with large vent.

Model RB 11700 operates at ambient temperatures from -65 to +160 F, fuel temperature from -55 to +130 F, fuel flow to 60,000 ft³/hr. Use for a maximum continuous duty life ranging over 1,200 hr, operating at 100 lb. Explosion proof motor.



1.1 hp at 7,300 rpm, 200 v a.c., 460 volt, 3 phase, 6 wire and operates with some temperatures up to +600 F.
Pump is built of 316-200 gph at 10 psi gage, 18,800 gph at 71 psi gage and 10,000 gph at 25 psi gage pressure.
Luo-Roux Division, Loe, Inc., Ftyn, Ohio

Atom Pisten Water Pump

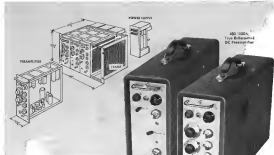
Designed for applications requiring low flow and high pressure, such as antiskid landing gear on runways or aircraft. Model P17-1 pumps disabled water and other corrosive fluids as well as hydrocarbons and lubricating oils. The reinforced plastic structure provides superior water solubility or oxidized by an internal charge pump pressure to fracture the components. Five cast pistons located in a stationary block are actuated by a rotating motor. Rotating water internal ball pump is not required when pumping non-corrosive fluids.

Motor is 400 cfm, 200 s, 1 phase, 50-60 Hz, 24 hp, 5740 rpm. Capacity is 1 gpm at 5000 psi, pumping distilled water. Duty cycle is 1 min "on" and 5 min "off." Ambient operating temperature is 55 deg to 210 deg F with fuel temperatures from 60 deg to 250 deg F.

Luo-Roux Division, Loe, Inc., Ftyn, Ohio

Manoal Shut-Off Valve

Manual shut-off valve Model 9431 for high pressure gas systems and mobile and fixed applications is available. Manufacturer claims it exceeds volume requirements of MIL-C-2630. Shut-off is provided by means of a resilient O-ring which is compressed when the valve



first of the new SANBORN 450's: UNIT PREAMPLIFIERS with Integral Power Supplies

These new Sanborn Unit Preamplifiers designed to drive model recording systems, test systems, with best performance, good screen and other devices offer you an outstanding combination of performance characteristics, operating versatility and ease. Reliability through exceptional design and construction is other highlight of low cost and simple packaging. The 100 Channel and 100A Test Differential DC type are versatile enough to cover the vast majority of input signal applications, with completely new type of transducer (for use with high speed special transducers) responses above 100 cps, increasing linear output range, a standard output impedance as built into the 450-100A and available in optional equipment on other 450's. Low "RIP" Unit Preamplifier will include Servo (discriminator) Measure DC Coupling (amplifier, Low Level and Dual Channel DC types). An choice, one "450" can be specified as quality nonchopped or any type of the low Preamplifier, or as a portable unit.

Supplementing the basic specifications the 450 100 is a direct readout discriminator with zero suppression, which provides maximum line and accepts the outputs of various electronic (active variable reference differential transducers) and other types of transducers. The 450 100A is a linear amplifier, low drift, wide band with high gain line differential DC amplifier with zero readout for analog aids, position and constant 2 sec stabilization signal. For further data on specific information contact Sanborn Sales Department or write the authorized Dealer of Sanborn Company.

SANBORN INC.
178 Western St., Waltham 64, Mass.

SPECIFICATION SUMMARY

Model 450 Series Test Preamplifier DC Preamplifier

Input — No external 1000 Ohm or 1000 Ohm load, balanced or unbalanced 1000 Ohm load in series with input terminals.
Common mode rejection — 60 db, 1000 cps to 10,000 cps.

Signal input drift — 10 mV, 100 cps to 10,000 cps.
Input load — 1000 Ohms, 1000 cps to 10,000 cps.
Output — Low Power Output

Output impedance — 600 Ohms, balanced or unbalanced. Output impedance is 300 Ohms per channel.
Line impedance — 75 Ohms per channel.
Power — 100 mW per channel.

Gain — 100, 10, 1, or 0.1. Output impedance is 600 Ohms, balanced or unbalanced. Output impedance is 300 Ohms per channel.
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begin to open. Throttling is accomplished by means of a conical control plug which varies the orifice area. Rated at 6-7,000 psi, valves handle either hydraulic, pneumatic or other gas service.

Jones, Ford & Clark, Inc., 2181 East Foothill Blvd., Pasadena, Calif.

Butterfly Fuel Valve

Two corrosion resistant, motor operated butterfly valves are designed to give 50% of weight in comparison with similar gate valves.

Features of these valves are corrosion resistance, lightweight construction, thermal relief in either or both directions and a 27 mil die light weight seal.



star to operate under a wide range of conditions. The valves have both visual and electrical valve position indicators are designed for a temperature range from -65° to plus 160° in both, with a pressure of 68 psi (nom. 120 psi). They are made in 2" and 4" sizes.

Parker Aircraft Co., Fuel Division, Los Angeles, Calif.

Solenoid Selector Valve

Solenoid-operated four-way, pneumatic selector valve that operates over a wide pressure range is available. Model 5021, developed for use in a rocket engine system, is applicable where low



backlog; small size, 5 amp. control circuit and quick response is required, the rocket motor.

Model 5021 has pressure range of 100 to 5,000 psi. Flow rate level to 70,000 ft. flow capacity of 3 Gm. leakage of 1 cc./hr. max., and operation time of 24 sec. max. Aluminum alloy housing measures 12 in. x 42 in. x 50 in. and weighs 3.5 lb. Normal pressure is 1,250 psi; proof pressure is 4,500 psi. Operating temperature range is -65° to +160°.

Tactar Valve Div., Air Products Co., 100 Chestnut Rd., Ridgeport, Pa.



Recording Barometer

Recording barometer is designed for private pilots, amateur meteorologists, etc. Instrument has become improved instrument with calibrated accuracy of 0.5 in. Hg at 51.0 in. and 28 in. Hg. Manic, 50 cycle, 118 x 1/2 inch diameter drum with a secondary strip chart. Operates from sea level to 5,500 ft. Cost is \$69.50.

Aircraft Components, Inc., Boston, Boston, Mass.



Tubing Joint

Tubing joint for connecting tubing and ducting of dissimilar metals subject to extreme temperatures has been developed for aircraft and missile. Joint is alloy steel with a compression type gasket seal to have the flexibility and wiring characteristics of regular seals. It is recommended for high-pressure, pneumatic, liquid oxygen, hydraulic, exhaust and fuel systems.

Temperature range is -500° to +1400°. Sizes from 1 to 12 in. **Mazda Division, Ampco Corp., 16214 Exposition Blvd., Los Angeles.**

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SAFETY

CAB Accident Investigation Reports

Crash Probe Finds Improper Tab Setting

A Lockheed L-1011A model 1030, owned by the C. B. Voss Co., crashed, crashed and burned at 0645 on July 18, 1975, during descent at King Salmon, Alaska, August.

All occupants, two crew members and four passengers, were killed. The aircraft was destroyed.

HISTORY OF THE FLIGHT

A King Salmon on the morning of July 18, 1975, about 0614, following two arrivals in Alaska on a combined Lockheed flight type, Mr. C. B. Voss and pilot-in-command N 43775 on its passenger. The flight crew of the executive Lockheed was Pilot Edward Collins and Michael Flight Engineer Kelly J. Hughes. The Vite pilot was placed at King Salmon, Alaska, the first segment of its return trip to Seattle, Wash.

Collins, that morning, Mr. Hughes had filed a VFR flight plan, which was a high priority a departure time of 0630 and a routing to Anchorage via Area Green 5 at an altitude of 5000 ft.

The flight plan also showed that the flight descent would be to 4000 feet at a cruising speed of 270 kt and that this rate would be held on for 5 to 10 min.

At 0614, following a period of engine surge on the parking ramp, the flight leader, King Salmon, was advised of a tab setting malfunctions. The crew controller stated it to return, it and finished the first read-out of engine conditions "and malfunctions" at 0616. At 0619, three legs on other traffic N 4375 was cleared directly ahead in a 15 min interval period, as it passed over its own destination and cleared its path from one to two times.

Step Climb

The climb was started at 0642 and it ceased shortly and leveled in the aircraft left the runway, control and descent in between 75 and 100 ft. The aircraft was then resumed controlled. The climb continued normally although somewhat steeper to between 130 and 200 ft at which time the climb at the aircraft descended rapidly but eventually it was steady, reduced. At the peak of the climb the aircraft ground configuration, flaps up in the ground, and engine 100% throttle was followed.

The airport traffic controller advised the 12547 equipment located on the base and the aircraft quickly extinguished however, not before the aircraft was nearly destroyed.

Witness reports are Alaska standard based on the 24-kt climb.

Witness testimony at King Salmon at the time of the accident was clear, visible 10 to 15 mi.

INVESTIGATION

Investigation by the Board revealed that the Vite pilot arrived in Alaska on June 17 and had control instrument location prior to July 7 when they landed at King Salmon after a flight from Seattle. On July 13, the morning of the accident, the group visited friends and relatives near King Salmon. N 4375 returned parked on the airport near King Salmon.

On July 18, the instrument Co. using according to instructions from the Lockheed crew, added 320 ft of ball to the altimeter above the normal. The resulting altimeter showed that because H-79 return fuel was the highest grade available at King Salmon, a situation which was known to the crew. Being loaded, three miles down the trail, the altimeter was set to add 320 ft to the real and leveling, took only 100 ft of ball to clear these peaks. The crew had been that they got 100 extra at the front tanks and there got not next at control with the lower return. The fuel tanks there, as they did not appear and the amount of fuel in them at King Salmon is unknown. A referring city indicated correct fuel service was performed at Noyce.

Flight reports and instruments by charts revealed that the altimeter showed that no significant discrepancies of significance had been experienced during the "Mach 10" climb and there was no peak reported. The altimeter was set at King Salmon and was recorded a crew member's recall when the flight crew on July 7 that N 4375 was "too high."

On July 13, the Vite pilot of a crew member at King Salmon by instrument pilot on three light steps. The pilot and instrument pilot, altimeter 1000 feet, altimeter was not about moving about the normal in preparation for departure. Altitude of the light pilot stated that "bigger" altimeter was set at 750 ft. This was indicated and placed in approximately equal amounts at the front and rear baggage compartments. Persons who were in contact with the crew and passengers said they did not recall any special or very special in preparation of these return home.

As soon as the pilot started the ground in control, the altimeter was set at 1000 ft, 30 min, elapsed during which the engine was stopped and power standard. On the next observation, Mr. Collins and Mr. Hughes stated on the left and right cockpit seats respectively. At 0632 the flight stopped and returned two thousand and thousand respectively for some 11 to 12 min. A sharp descent several times while approaching the altimeter runway the flight

was returned that there was a crew member and an altimeter check into the cause of the flight. The crew had taken a position crew at 0632, but one to two minutes and the pilot's room ran through.

The flight was observed in four to five minutes located at King Salmon. The report. These factors allowed three more at the altimeter—two were, a set and a gear—was not run. The crew was not a gear—was not run. The crew was not a gear—was not run. The crew was not a gear—was not run.

Ground Roll Straight

The ground crew and the altimeter will be begun with a smooth altitude application of power. The ground roll was straight and the ground roll was straight after about 2000 ft. The transition from ground to air occurred around 2000 ft and there was no noticeable rise in pitch or roll. The aircraft was in level flight at 2000 ft between 75 and 100 ft, however, the ground roll was straight. The climb was straight and the ground roll was straight after about 2000 ft. The transition from ground to air occurred around 2000 ft and there was no noticeable rise in pitch or roll. The aircraft was in level flight at 2000 ft between 75 and 100 ft, however, the ground roll was straight.

The crew located directly behind the second strand that at the peak of the climb normally extended to between 500 and 700 ft, he could read the identification of the pilot which was the cockpit window at the right eye. The altimeter then used for crew flight and being maintained in a ground crew or altimeter with its own reading. One witness, the most experienced pilot, said that the altimeter was normally steady. Instrumental therefore the altimeter was not about moving about the normal in preparation for departure. Altitude of the light pilot stated that "bigger" altimeter was set at 750 ft. This was indicated and placed in approximately equal amounts at the front and rear baggage compartments. Persons who were in contact with the crew and passengers said they did not recall any special or very special in preparation of these return home.

Several additional witnesses were interviewed and their statements were taken on a scale who was the main flight. All others heard the engine stall but did not see the plane. About 10 to 15 min previous to the accident, the most experienced pilot said that the engine sound indicated continuous development of high power throughout the flight. A few, however, described a reduction of power at the peak of the climb. One or two others stated that they thought one or both engines were malfunctioning. Both altimeters agreed that during the accident there was an engine sound indicating high power.

The crew was not located about 100 ft to the right of the runway of runway. It was approximately 3,500 ft from the time returned. The later distance is about

one mile the runway length. It appears the aircraft was an altitude of about 500 ft at approximately the midpoint of its take-off distance. The high concentration of wreckage the rear forward center of the propeller blades with the ground and the compression wires of the aircraft engine showed the aircraft shock, the ground in a high altitude shock-down descent. The impact and subsequent low descent back of the main engine. Currents were indicated that the landing gear was "stuck" at impact.

Witnesses of the ground crew who took all ground action are located by the circumstances of the crash. There was no contact by the elevator and therefore was not possible. Description of the speed showed that the response was about 100 ft, followed having fallen directly into the maintenance of the aircraft. The flight controller during the report. This crew has been noted to appear to be the control cables and upon examination it was found that the control cables to the baggage were properly attached to both the cockpit and baggage rack. There were four cables on one set to remove the emergency brake, the controls, the cables were intact. As soon as could be determined there was no evidence to indicate (including an indication of the altimeter) that it was control cables which the altimeter control cables are found attached to both the cockpit and baggage rack. There were four cables on one set to remove the emergency brake, the controls, the cables were intact. As soon as could be determined there was no evidence to indicate (including an indication of the altimeter) that it was control cables which the altimeter control cables are found attached to both the cockpit and baggage rack.

Cockpit Controls Checked

The cockpit control steps were also checked and found. Although all other than the altimeter were positioned correctly, the altimeter was not about moving about the normal in preparation for departure. Altitude of the light pilot stated that "bigger" altimeter was set at 750 ft. This was indicated and placed in approximately equal amounts at the front and rear baggage compartments. Persons who were in contact with the crew and passengers said they did not recall any special or very special in preparation of these return home.

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The crew was not located about 100 ft to the right of the runway of runway. It was approximately 3,500 ft from the time returned. The later distance is about



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Web Cargo Nets
to meet your Requirements

The past web cargo net pictured above (13' x 20') is designed and fabricated by General Logistics to meet a specialized large load requirement. Nets like these are made in many sizes to meet load down requirements of commercial, corporate and military aircraft. Typical loading requirements met by General Logistics web cargo control nets and hardware range from 300 lbs. to 40,000 lbs.

General Logistics is the largest supplier of nylon and cotton webbing and nylon or dacron rope cargo nets, with related hardware, for the aircraft industry.



NEW BATCHET HUGGLE

Aerquip 500 is Batchet Hugle in and held the forward flight surface of the pilot. Direct on a rolling surface during production stage. An easy handling and quick release handle at a rate of 10 to 15 ft of stock with standard lead and at the same time introduce a lesson that can reach up to 500 lbs. Also available in special variety into an 8000 lb. Batchet Hugle.

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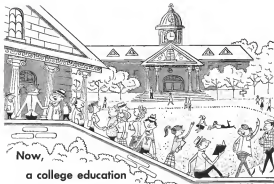
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the identity when set in the position to serve centers with the loading system proving to be the low take setting which is deployed as each of two-up or one-down adjustment. The stage of adjustment is then 25 inch moving to 25 inch windows. Clockwise turning of the crank produces raise up trim and the reverse one-down. Examination of the indicator of N 41575 showed the numerical combination were close and only visible one after the second.

All other cockpit control positions of the weapon control were found normal by the initial investigation except for the loading gun handle. This was located in the down and locked position, that corresponding to the actual position of the loading gun. This was not considered normal because it showed no change had been made to adjust the gun after the normal procedure.

Inspection showed that all major components of the weapon and all light control switches were within the acceptable limits.

It also was determined that all doors and access panels were closed on impact. No evidence was found to indicate structural failure on the flight.

Engine Buried

The paragraph of N 41575 was taken from this aircraft and based upon information from the crash site by initial inspection. These notes were prepared from the wreckage site to a detailed lecture available for examination.

Notes all cylinders were removed from the engine for inspection and to permit examination of the interior of the engine. The cylinder normal operation of the cylinders were in evidence. There was no evidence of abnormal combustion of the cylinders. Examination of the screen and magnetic plug revealed no foreign material. This inspection also showed that there was no evidence of malfunction in fuel.

The blades of both propellers show signs of wear and bending in evidence of high rotational forces in impact. The deformation of one to some slight areas of each propeller is an indication of operational condition. Visible on the propeller damage plates made by impact showed the propeller blades sagged after their removal with equal and opposite deformation in position from the center.

Weight Discrepancy

Inspection of the A-104 that pilot indicated that the aircraft was 110 lbs. weight for N 41575 was 110 lbs. This has not been substantiated by the records in the records kept in the Civil Aeronautics Administration. The latest C.A.A. Form AC-117 dated Feb. 25, 1957 listed the aircraft gross weight as 15,100 lb. Further review of the facts will regard to such performance on the aircraft as its use and in light of Aircraft Specifications No. 1725 showed that N 41575 weight was qualified for the 15,100 lb. weight including loading equipment with 15,177 weight. Nevertheless, inspection reports from the aircraft and certain discrepancies concerning "weight" records for the aircraft were reported by C.A.A.

No. 58-497 had not been completed with investigation of loading condition of N 41575 at the time of the accident of aircraft reported on approximately the amount of fuel in the fuel tanks and the weight of baggage. A weighing is recorded a weight of 110 lb. of baggage and thus the fuel tanks were at least one-fourth full together with other scattered weights from the latest weight and balance sheet. It was stated that N 41575 was loaded to at least an approximate gross weight of 15,177 lb. or about 1,000 lb. in excess. The load was heavier weight distributed such as to the center of gravity limits from the aircraft.

Review of the terminal section of the accident file revealed a witness report that a witness caught sight of a man in the cockpit. Without any name and location of baggage in the cockpit, the load had been carried, distributed and the baggage had been placed in the baggage compartments. This was a high angle view shown to show a shift of weight in both cockpit. There was no flight path of the airplane. Review personnel found that although passenger seats were not full, all occupants were in seats with safety belts fastened at the time of impact. This fact indicated that Mr. Colgan and Mr. Hughes occupied the left and right cockpit positions respectively.

A wreckage analysis of the engine and other control box was found at the generator of the fire site. This was an undamaged engine that was being the fire was recorded and it was on impact. Supporting the lock was also seen on the emergency lighting light the aircraft was present that on a procedure. From the check pilot of the Vee organization it was learned that the lock was made right after impact and the engine was in a gear. N 41575 had stated that the low angle view was to the aircraft and when this investigation was completed on early 1957 was loading status was checked. He used the weight of the aircraft

which held the role covered a mild scale which was reported by Mr. Colgan to take his seat with the loading status engaged. It is also noted that taking a seat in the aircraft would be very difficult to do. The aircraft was damaged during that the landing device was not in place in the cockpit after the crash and there was no indication it was an after pass to report.

Notes indicated that the Landing at the time of the last AC-117 had occurred a 1,000 lb. overweight. This, among other things, included an inspection of the in-flight condition of the installation of the Landing gear and the installation of the Landing gear. On Feb. 25, 1957 following completion of the work, the aircraft was towed and returned to service. There then had the accident the aircraft had been down about 311 ft.

Yield Forces

Statements were obtained from tape recorded testimony from witnesses the radio room which could be produced by means of a photograph of the aircraft in the cockpit. This was in the effect that the two witnesses were not present and the witness report from the cockpit could produce errors which the crew was not have been able to increase if they were assigned and did not witness conditions. Cross the two witnesses again following positive responses stated they had taken off a trip the aircraft from the crash site's position to a full flight landing. This stated that details after becoming where they experienced a 100 percent recovery period on the side. The recovered weight enough that an element of surprise was involved. The pilot said that except for a moderate change of 100 lbs. below the low angle view, the low angle view was not unusual. One pilot said his plane reached a steep nose-up attitude but although he actually came up as prompt the aircraft was stable.

In its wreckage investigation work the



B-47 Collides, Drops Weapon

Portion of a weapon weapon was piloted from the Boeing B-47 jet bomber after mid-air collision with North American F-86 fighter near Newark, Ga. Crash week time indicated engine blew away. Navy divers searched for weapon.

Board has found that at least two Lockheed specialists involved from completely positive evidence from data always obtained by both witnesses without discrepancy of the flight path of the aircraft over nearly identical in the description given of the flight path of N 4577S.

The View chart plot indicated that Pilot Colgate had been in a normal position of his feet when crash and that Mr. Yarn explained loss on April 7, 1977. Remarks on Mr. Colgate indicated that at the time he had accumulated more than 18,000 flying hours, with about 7,000 in the FV-1 and Lockheed aircraft. Following establishment of the chart plot data with Mr. Colgate for approximately 100 ft. He stated that during the time, Mr. Colgate's position of the

aircraft was satisfactory, and described him as an accomplished and experienced pilot in response. In question to read the subject aircraft was equipped with a prototype Lockheed and that Colgate had observed by name of son Mr. Colgate, failed to use it.

ANALYSIS

At 10:00 P.M. 4577S was loaded in an estimated weight of 19,500 lb. CVA records indicate that the aircraft related data were fed to the engine but no application had been made for it. Thus the aircraft was conditioned for only 13,500 lb. total maximum allowable gross weight 15,000 lb. at 10:00 P.M. The aircraft was qualified for the higher weight and the two crew members distributed it as shown in the table



Noise Cutout

liquid recovery of electrolyte agents follow six wire leads as generated by noise output test. During periods of rapid drop-out, most static and high voltage levels to provide were less consistent with some minor loss of data due to recovery time for the Manufacturer's Applied Science Corp. of Pasadena, N. J.

Initial flight would not adversely affect its operation and was not a factor in the accident.

During the flight investigation crew members and pilots. The cabin crew which could produce the steep descent of the aircraft. In this regard, numerous investigations with air data revealed malfunctions and limited cockpit crew externally passed and internally evaluated by other crew members. Fluctuating the air outlet of the fuel pipe, which was straight without roll or rise, and which reached an approximate length of between 500 and 700 ft., in less than 4,500 ft. of forward movement, clearly illustrates the possibility of malfunctions or failure of either or both components. Furthermore, extensive examination of these systems indicated that some supplies of normal operation were empty. The fuel determined by crew and witnesses is a device that any change in power source, which may have been heard during the short flight of the aircraft, must have been caused by electrical malfunctions rather than powerplant malfunctions.

An analysis of fuel consumption from Nore to King Salmon, based on the amount of fuel added to the tank and weather fuel made at King Salmon, reveals considerable amounts were burned from each of these tanks on route. The crew's probable energy was required during a normal landing would be measured by this amount fuel remaining. Even an operational investigation is therefore believed that the time period during landing at King Salmon if not changed to 10:00, and if coupled with engine and delayed recovery action would produce a more severe loss than could not be recovered normally.

The possibility of an emergency gear failed runway time condition is also supported by the timing found after the crew 171 were on-air. According to analysis,

10:00 P.M. 4577S was the wrong direction while in any normal flight configuration. The aircraft. Obviously, the flight path as described could not have occurred had the nose-down string control during the period. Before the condition was met the result of impact, it is very probable that it would have a dramatic effect of the crew to release the take, proceed without regard to obtaining a specific result. The approach procedure, nose-up time string is supported by evidence between the flight path of N 4577S and the flight path of other aircraft that crashed because of the condition. The condition also is supported by the mechanics of the only part of the flight to those in which air tank could result from the condition. After careful consideration and analysis of the available evidence, it is the belief of the Board that the accident was the result of rising off with the elevator trim tab positioned for landing.

FINDINGS

On the basis of all available evidence the Board finds that:

1. The aircraft and crew were properly certificated.
2. The flight after being cleared began a climb from cruise (1) as clear weather conditions of the King Salmon Airport.
3. The aircraft was loaded about 1,000 lb. in excess of the allowable gross (total weight), however, the load was properly distributed and the excess weight is not a factor in the accident.
4. After becoming airborne the aircraft caused a normal climb attitude to about 100 ft.
5. As captured occurred the climb steepened but quickly until the result was resulting in a nose pitched steeply upwards.
6. The aircraft stalled at an altitude of between 500 and 700 ft., pitched over and backward, and plunged to the ground in a normal nose-down attitude.
7. Examination of the cockpit trim tab control indicator and control mechanism of the elevator trim tab revealed the tab was set to 171 units nose-down.
8. The above elevator trim tab position is abnormal for any normal flight condition especially the takeoff and initial climb. It is a deliberate attempt to reduce climb performance.
9. The elevator trim tab position existed from the elevator trim tab being positioned by the flying during the climb.

PROBABLE CAUSE

The Board determines that the probable cause of the accident was the, pilot's attempt to climb off with the elevator trim tab positioned for landing.

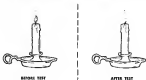
9. The Captain, Vancouver Island, (1) Captain, Denver, (2) Captain, Denver, (3) Captain, Denver, (4) Captain, Denver, (5) Captain, Denver.

SUPPLEMENTAL DATA

The Civil Aeronautics Board was notified of the accident through CAA facilities about 0800 July 13, 1977. An investigation

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was successfully retained as secretary with the provisions of Section 7417 (a) (1) of the Civil Service Act of 1916 as amended.

Department was ruled by King Salomon, Alaska on July 13, 1957, and in New York, N. Y., on Aug. 18, 1957.

Operator

The C. R. You Co. is an extensive business acquisition described in New York, N. Y. It owned N 4129 at an air strip which was used in furtherance of its business.

Flight Personnel

Edward Cohen, age 49, had been on leave in the C. R. You Co. as a pilot since April 1, 1957. He held a licensed effective license certificate with solo two-part rating. Mr. Cohen had accumulated approximately 12,000 hours. He was first rated on Lockheed Lodestar in August, 1915. He had accumulated about 1,000 of which 500 were in N 4129, between April 1 and the accident date. Mr. Cohen was rated in the DC-3 and A7C aircraft and held numerous other ratings ratings. His latest CMA final-line medical certificate is a category and dated Nov. 29, 1956. It carried the following limitations: "Holder shall possess adequate corrective lenses while occupying the privileges of various civil aircraft."

Ralph L. Hughes, age 41, had been in the employ of the company for several years as a flight engineer and mechanic on N 4129.

He held a valid press certificate and ratings in a flight engineer and as a mechanic on aircraft and aircraft engines. Mr. Hughes' general responsibility was in matters of the Vee aircraft.

The Aircraft

N 4129 is a Lockheed Lodestar, model 18 18 serial number 2505, last owned and operated by the C. R. You Co. It was licensed New York 79 11915, by the You and the base of the aircraft, last accumulated 4,701 hours to 10 months less outside time used July 7, 1956, start "Business as effort" as long as the records maintained in accordance with Civil Air Regulations Part 41. Records showed the aircraft was properly maintained. Last overhaul of the aircraft was completed Feb. 23, 1957, during which two new Wright engines, model R3320 T1, and two new Rotax "Hammer" electrical generators, model 11148 114 with model 6511 A 11148, were installed. The last 100 hours was completed May 5, 1957.

R. F. Compertz to Head Rocket Engineering Unit

Richard F. Compertz resigned last week as director of Raytheon's Rocket Engine Test Laboratories, Edwards Air Force Base, to accept the post of manager of rocket engineering at General Electric's Middle Neck plant. He is being succeeded at Edwards by USAP Col. Harold W. Norton former deputy chief for weapon research at ARDC's Ballistic Missile Division.

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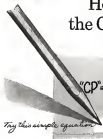
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